FINAL ENVIRONMENTAL IMPACT STATEMENT ON

COLSTRIP ELECTRIC GENERATING UNITS 3 & 4, 500 KILOVOLT TRANSMISSION LINES & ASSOCIATED FACILITIES

ENERGY PLANNING DIVISION, MONTANA STATE DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

HELENA, MONTANA 59601

JANUARY, 1975

NRIS #11

FINAL ENVIRONMENTAL IMPACT STATEMENT ON

THE PROPOSED MONTANA POWER COMPANY, PUGET SOUND POWER & LIGHT COMPANY, PORTLAND GENERAL ELECTRIC COMPANY, PACIFIC POWER AND LIGHT COMPANY, AND WASHINGTON WATER POWER COMPANY COLSTRIP ELECTRIC GENERATING UNITS 3 & 4, 500 KILOVOLT TRANSMISSION LINES FROM COLSTRIP TO HOT SPRINGS, MONTANA, AND ASSOCIATED FACILITIES

ENERGY PLANNING DIVISION
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DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
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JANUARY, 1975

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SECTION ONE: RECOMMENDATIONS

The Department of Natural Resources and Conservation recommends to the Board of Natural Resources and Conservation that application for a certificate of environmental compatibility and public need for Colstrip Electric Generating Units 3 & 4, two 500 KV transmission lines, and associated facilities be denied for the following reasons:

I. The Department is not persuaded that there is a basis of the need for a 1400 MW facility in Montana.

A. Recent economic data demonstrate that the nation, region, and state are experiencing a decline in the rate of economic growth. While this may change, no responsible economist has predicted a rate of economic growth in the next decade as high as that experienced in the last. With slower economic growth, the rate of growth in the demand for electricity can be expected to decline, especially if capital for industrial expansion remains difficult to obtain.

B. The obvious trend in the price of electricity is upward. The Bonneville Power Administration (BPA), for example, recently announced a price increase of nearly 25%. As prices increase, growth rates of demand can be expected to decrease.

While the precise effect these factors can have on growth rates may be difficult to quantify, their influence cannot be denied and is apparently already affecting the Pacific Northwest Power Pool (PNWPP) system. For example, actual energy load in the PNWPP during the past year was 6% less than that originally forecast by the PNWPP.

A second example is the modification of projected growth rates. For instance, in December 1973 PNWPP projected a demand for average annual energy of 26,671 MW by 1979. One year later, in December 1974, the forecast was for 26,312 MW, or a reduction of 359 MW, which is approximately one-third the energy that could be delivered by Colstrip Units 3 & 4.

Still another example is the announcement in December 1974 by Pacific Power and Light (PP&L) that, because actual load growth patterns experienced by PP&L simply have not paralleled projected forecasts, the completion dates for two 500 MW units of the Jim Bridger plant in Wyoming have been extended by 6 months, and the completion date for another 500 MW unit by one year.

Pacific Power and Light added that the reduced load growth makes such revisions in generating requirement schedules both possible and practical.

C. It is important to place the amount of electricity that could be delivered from Units 3 & 4 in perspective with the system to which the units would be interconnected. Changes which affect the whole system will, to a large degree, be reflected in the operational capability of applicant companies, and small changes in growth rates will have significant effects.

   All the power that could be delivered by Colstrip Units 3 & 4 (1400 MW at 80% load factor with 5% line loss = 1064 MW) constitutes approximately 4% of the projected average annual energy demand (26,312 MW) for the PNWPP in 1979. A 5% reduction in demand would mean that the system would need approximately 1300 MW less energy in 1979.

D. Montana Power Company (MPC) projects that peak demand will exceed peak resources in its service area by only 400 MW in 1985 and that average annual energy demand will exceed energy resources by only 121 MW in the same year, excluding reserves.

   In the first few years of operation, all or most of the power generated by Units 3 & 4 would be available for export.

The Department is not persuaded that there is a need for 1400 MW in Montana, at least not within the next decade.

II. <u>The Department is not persuaded that reasonable alternatives to the proposal do not exist</u>.

A. Conservation

The Department is not persuaded that a well-organized, long-term, intensive conservation campaign, together with the effects of a depressed economy and higher electricity prices, would not delay the dates by which demand would permanently exceed available generating resources.

While the Department is not suggesting that conservation measures can totally eliminate the need for additional power, it has not been convinced that applicants have chosen to pursue the alternative of adopting and encouraging conservation measures which could reduce the need for more energy. If anything, applicants have taken the opposite approach, as is evidenced by their support for promotional activities urging increased use of energy.

B. Construction of a plant with a capacity more in line with the need for increased energy in applicants' service area in Montana.

In its 1974 long-range plan, MPC has proposed construction of a 350 MW facility if the proposed facilities are not approved. This appears to be consistent with projected demand in Montana.

Using MPC figures including reserves, projected firm energy load will exceed available firm energy resources by only approximately 50 MW for the period of July 1980 to June 1981.

While applicants have suggested that the economies of scale associated with a 1400 MW facility would substantially reduce consumer rates (by 5 million dollars per year) as opposed to a smaller facility, the Department is not persuaded that economies of scale for thermal generating facilities are significant beyond 500 MW capacity or that the claimed economies of scale would result in substantial savings to Montana consumers.

If, however, economies of scale to the extent claimed can be realized, then, because most of the energy would be exported, the benefits of the proposal would accrue in larger proportions to consumers outside the state.

C. Location of another facility more in line with projected needs in another area of Montana which will minimize the environmental and social impacts and maximize the economic benefits.

D. Temporary generating facilities

Gas or diesel turbines can be used for short-term supply of power. Although costly and inefficient for long periods of use, this alternative has been used in other areas to compensate for short-term deficits while permanent generating facilities were being constructed.

E. Rescheduling of maintenance plans to aid in avoiding temporary periods when demand would exceed capacity.

A combination of the approaches discussed above would alleviate the concern of demand exceeding supply until the implementation of permanent alternatives for Montana other than the applicants' proposal.

F. Acceleration

Instead of extending construction schedules, as was done by PP&L, it appears reasonable that the time when these plants could be brought on line could be accelerated. Plants which are being considered for operational dates approximating those of Units 3 & 4, such as the 500 MW proposal for Boardman, Oregon (which has already received a favorable staff report by the Oregon Siting Authority), could be moved ahead much faster. If a critical need for power in applicants' service areas outside Montana exists, it appears that regulatory agencies in those areas should accelerate the review schedules and approve the construction.

The Department is persuaded that the lead time for the implementation of permanent alternatives can be reduced through accelerating construction schedules and shortening the review and approval periods of regulatory agencies.

G. Shipping coal via unit trains

Calculations done by the Department indicate that shipping coal by unit trains is not an economically unreasonable alternative to transmitting energy through transmission lines.

Other information supports this conclusion:

1. Studies done by the Federal Power Commission.

2. Existing contracts or plans for coal shipment by unit trains from Montana or Wyoming to plants beyond their borders.

Origin	Destination	Approximate Amount (Million Tons/Year)	Approximate Distance (Miles)
Decker	Austin, Texas	2.2	1,600
Wyoming	Redfield, Ark.	5.0	1,280
Wyoming	Boardman, Ore.	2.5	900
Colstrip	Columbus, Wisc.	4.0	1,000
Decker	Chicago, Illinois	7.0	1,200

In the first three examples, new plants are being built in those locations, recognizing the economic costs involved.

H. Considering the apparent feasibility of coal shipment, the alternative of siting plants outside Montana is viable and has been, in fact, the alternative chosen by all other users of Montana coal except the applicants.

III. The Department is not persuaded that the proposed facilities represent the minimum adverse environmental impacts for the state of Montana.

A. Impacts of the proposed facilities if built:

1. Emission impacts

a. Degradation of existing air quality

The efficiencies of the emission control system of the proposed facilities are equivalent to about 99.5% particulate removal and 40% SO_2 removal. Based on these efficiencies, the particulate emissions from each proposed unit would be 367 lb/hr., and the SO_2 emission would be 9,583 lb/hr. Assuming 80% annual load factors, the proposed facilities will emit 2,500 tons of particulates and 67,000 tons of SO_2 per year. These massive amounts of pollutants will enter the atmosphere, and, regardless of how they will be dispersed, they will degrade the surrounding air quality. This degradation of air quality is unacceptable because of the environmental impacts, even assuming the above efficiencies could be met. The Department is not convinced that the heterogeneity of the sulfur and ash content of the coal will allow the applicants to meet federal and state emission standards.

After examining the available data, the Department is not convinced that the proposed facilities will meet federal and state air quality standards.

The Environmental Protection Agency (EPA) has recently adopted <u>Air Quality Implementation Plans on Prevention of Significant Air Quality Deterioration</u>. The Colstrip region has been designated Class II. The Department is concerned that the proposed facilities will violate Class II air quality standards.

b. Significant damage to vegetation, certain crops and mining reclamation species

If the nature and quantity of the pollutants described above are emitted, significant damage to vegetation and certain crops will occur. Because of its higher sensitivity, ponderosa pine will manifest damage earlier than other species, and its damage will be more severe. This level of pollution will also damage certain mining reclamation species. Young, succulent, fast growing species will be susceptible to significant damage.

2. Impact of the proposed two 500 KV transmission lines

Fourteen thousand acres of land will be needed for right-of-way. Additional thousands of acres of land will be converted to new access roads.

The proposed transmission corridors will permanently eliminate timber production from commercial forests. During construction, agricultural production, including crop and range production, will be excluded from right-of-way and temporary access road areas for periods of one to three years, depending on construction time and construction practices. The transmission lines will present adverse visual impact on existing environmental quality and recreation and leisure potential. The corona effect of the proposed transmission lines may produce radio and television interference, especially during foul weather.

3. Social and economic impacts on local communities

The social and economic impacts of the proposed facilities will be

concentrated in Rosebud County, including the cities of Forsyth and Colstrip. Due to their small size, the sudden surge of population related to the construction of Colstrip Units 1 & 2 has inundated the local social and economic structure. The eventual change in local life styles, community services and local businesses cannot be exactly determined for many years to come.

Tax generated revenues cannot be used for timely impact relief; therefore, the quality of local services such as education, law enforcement, fire protection, sewage and water systems, roads and other governmental services will deteriorate. In addition, medical care, housing, and other community needs will not be adequately met.

During construction, the number of workers will range from several hundred to 1,600 or more at peak. The total construction period will last from 3 to 3½ years. Required construction workers will include boilermakers, carpenters, electricians, iron workers, laborers, pipefitters, operating engineers and other crafts. The ability of Montana unions to supply all projected manpower needs from their own memberships appears doubtful.

4. Economic benefits from the use of electricity

The primary economic benefit resulting from the proposed facilities is the use of electricty. Any other economic benefit generated from these proposed facilities is a by-product. More than 60% of the available electricity, and the economic benefits from the use of that electricity, are likely to be transmitted out of Montana. Therefore, a majority of the jobs, taxes, and other economic benefits created by putting the electricity to use will not be realized by the people of the state.

B. Conservation practices

When conservation is practiced effectively in Montana and surrounding regions, the need for electricity generated by the proposed facilities could be eliminated. Therefore, without the building of the proposed facilities:

1. The existing air quality will not be affected.
2. The existing vegetation and crops will not be affected.
3. Impacts of the two 500 KV transmissionlines for a distance of 430 miles are eliminated.
4. Local citizens of Rosebud County will be able to reestablish and stabilize their communities after the impact of the construction of Colstrip Units 1 & 2. Taxes beginning to be generated from Colstrip Units 1 & 2 can be used to improve local community services and for local prosperity rather than being tapped to alleviate more impacts from new construction.

C. Coal Shipment

If the coal is transported to a western load center, and the proposed facilities are constructed and operated near that load center:

1. The existing local air quality of the proposed site will not be affected.
2. The existing vegetation and crops will not be affected.
3. Impacts of the two 500 KV transmission lines for a distance of 430 miles are eliminated.
4. Local citizens of Rosebud County will be able to reestablish and stabilize their communities after the impact of the construction of Colstrip Units 1 & 2. Taxes beginning to be generated from Colstrip Units 1 & 2 can be used to improve local community services and for local prosperity rather than being tapped to alleviate more impacts from new construction.
5. A small amount of emissions from diesel engines, short in impact duration and dispersed along more than 500 miles of railroad corridor, will have minimal impact on existing air quality.
6. Railroad shipment of the amount of coal needed for Colstrip 3 & 4 will provide an estimated 246 in-state, long-term jobs, compared with the prediction of 95 permanent generation station jobs created by the proposed facilities.

D. Impact of constructing a small generation plant near a load center in Montana

1. The beneficial use of the electricity generated will all be in Montana.
2. Because of the existing capacity of an urban center, the social impact

on local life styles and local community services can be minimized, the economic benefits to the local businesses can be absorbed efficiently, and employment opportunity can be maximized. If the plant is built in an area of degraded natural environment, the impact on air quality and natural ecological systems can also be minimized.

3. The necessity of constructing new transmission lines is minimized, as are the associated impacts.

4. Additional permanent jobs will be created from the transportation of coal.

IV. The Department is not persuaded that the obligation of Montana to the rest of the nation or the Pacific Northwest necessarily goes beyond making energy available through reasonable alternatives.

Montana is already making a significant contribution of energy to the nation.

A. Twenty dams capable of producing more than 1,000 MW of firm power already exist in the state. In this case the contribution goes far beyond the electricity actually generated in Montana. These storage reservoirs provide water for substantial downstream generation, and regulation of such reservoirs as Fort Peck, Libby, and Hungry Horse is based on maximizing power generation at these downstream reservoirs.

B. Coal production is expected to be 25 million tons in 1975, while only 1.3 million tons will be used in Montana. Coal production by 1980, according to contracts already in existence, will approximate 42 million tons, and all but 3.5 million tons will be exported.

With increased federal emphasis on Western coal production, these figures will probably be far exceeded in the decade following 1980.

C. A 700 MW project is being constructed at Colstrip, with 350 MW to be exported.

The state is absorbing and will continue to absorb the social, economic and environmental impacts associated with production of this energy.

While we do have special ties with the Pacific Northwest region, we also have special ties with all sister states in the Missouri River Basin, in the Rocky Mountain states, in the Western States and in the Union. Favoring one region over another is illogical. Allowing conversion facilities for all means Montana could become a boiler room for the nation and would be paying a double price in terms of environmental impact and the other resources needed for energy production.

In the absence of adequate regional governmental arrangements to evaluate energy conversion sites required by energy demands beyond our borders, with the state of Montana participating as a full partner, Montana cannot be assured that:

1. Sites chosen represent the minimal adverse impact on the environment.
2. Other criteria such as lack of political strength or low population density will not dominate site selection.
3. There will not be a strong tendency to locate sites long distances from load centers to minimize opposition to environmental impacts.
4. Large load centers will conserve energy as an alternative to expanding production as long as environmental impacts can be shifted to other areas.
5. The most efficient use of transmission and production facilities will be realized.
6. A fair share of the economic value of the energy use will accrue to the area in which the production facilities are located. By shipping power out, we are exporting the jobs that would be created by the use of the electricity, in exchange for the much smaller number of jobs that would be created by the production of electricity.

Without these assurances, the Department is not persuaded that Montana can minimize the environmental impacts and maximize the economic benefits of energy production for other than Montana's needs.

The Department strongly believes that formal regional governmental arrangements for plant siting, transmission line siting, and the sharing of environmental costs and economic benefits should be considered to ensure an adequate energy supply from facilities at sites which have a minimal adverse impact on the region.

V. <u>The Department is not persuaded that the proposed facilities will serve the public interest, convenience and necessity</u>.

The Montana Utility Siting Act requires that the proposed facilities will serve the public interest, convenience and necessity before they can be approved. On the basis of the Department's studies and the findings enumerated and discussed above, the Department is not persuaded that the proposed facilities meet that requirement.

The Department believes that reasonable alternatives to the proposed facilities are available for Montana and surrounding regions. The Department is not persuaded that these reasonable alternatives have been adequately considered by the applicants. Reasonable alternatives should be implemented before allowing another generating facility of any substantial size in Montana. In the Department's view, these alternatives will better serve the public interest, convenience and necessity.

The greater environmental impacts of the proposed facilities, as compared to the alternatives, must also be considered in determining whether the proposed facilities will serve the public interest, convenience and necessity. The Department's studies show that both short and long-term impacts detrimental to the social, economic and natural environments would occur as a result of the construction and operation of these facilities. On the basis of these studies, and considering the state of available technology and the nature and economics of the various alternatives, the Department is not persuaded that the proposed facilities represent the minimum adverse environmental impact. Therefore, the issuance of a certificate of environmental compatibility and public need will not and cannot serve the public interest, convenience and necessity.

Section II: Addendum to the Draft Environmental Impact Statement

This section includes additions and corrections to information presented in the draft EIS as well as responses to selected comments made by the applicants, government agencies, and individuals. In most instances, responses to comment are identified by an introductory reference to the comment being answered. Corrections and additions to the draft statement are interspersed throughout this section. Additions include information not available at the time the draft statement went to press (primarily time) and additions necessary to clarify or qualify passages in the draft statement. The additions are either identified with appropriate existing sections in the draft or, where a topic is introduced that was not included in the draft, identified as a new section. Corrections include revisions of statements and figures printed in the draft impact statement and corrections of typographical and other mechanical errors. Such errors were not corrected unless they obscured the original intent of the writing or conveyed faulty information.

5.1.2. Comparative Costs, p.61 (Table 5-1)

Table 5-1 from the draft statement has been reprinted on the following page, with considerable revision. This version replaces the original table.

6.3. Coal Content, p. 77 (Table 6-2)

In the last column (under "100% Cap Emission Rate g/sec"), opposite "^{226}Ra (raduim)", "Ci/hr" should read "Ci/sec."

6.4.4.2. Description of Control Efficiencies, p. 82 and 83 (Figures 6-5 and 6-6)

Figures 6-5 and 6-6 have received minor corrections. They have been reprinted as Figures 8-17 and 8-18 under Section 8.4.4.2. of Volume 3 in this final statement.

8.1.4. Soil p. 129-131

Delete Section 8.1.4. Soil, consisting of the last paragraph on page 129, all of page 130, and page 131 down to (but not including) Section 8.1.5. Vegetation. Substitute for it the following section:

8.1.4. Soils

8.1.4.1 Inventory

The impacts of the power plant and transmission facilities cannot be adequately evaluated without consideration of the soil resource. Problems of soil erosion in response to construction and maintenance of the proposed facilities, reaction of the soil to particulate and gaseous emissions, and overall land-use considerations--particularily those involving agricultural productivity--are directly related to the soil resource and are of prime concern in evaluating impacts of the proposed project.

The landform inventory technique used in this study based on the Ecoclass System developed by the U.S. Forest

TABLE 5-1

ESTIMATED ANNUALIZED COSTS OF COOLING SYSTEM ALTERNATIVES FOR COLSTRIP UNITS 1-4

Cooling System	Net Annualized Capital Cost	Annual Cost	Total Annualized Cost
Cooling Pond	$ 9,518,000	$2,620,000	$12,138,000
Spray Pond	$ 9,562,000	$3,080,000	$12,642,000
Natural Draft Evaporative Cooling System	$ 930,000	$2,770,000	$ 3,700,000
Mechanical Draft Evaporative Cooling System	$ 1,566,200	$1,230,000	$ 2,796,200
Dry Cooling	$16,935,400	$1,540,000	$18,475,400
Hybrid Wet-Dry Cooling	$10,242,600	$2,000,000	$12,242,600

SOURCE: Westinghouse 1973

Service (1973a), recognizes that the distribution of the soil resource is determined, in part, by factors of climate, physiography, native vegetation and the nature of the parent material. The physiographic features of the study area served as the base upon which the soil mapping units were developed. These four units were, in several instances, divided into sub-units reflecting additional soil resource information. A brief description of each unit follows:

Soils of the Mountains

1) Soils developing in material from non-calcareous consolidated rocks other than granite on very steep or steep mountain slopes with significant outcrops of bedrock;

2) Soil formed upon limestone bedrock on very steep or steep mountain slopes; the mapping unit includes some rock outcrops.

Soils of the Foothills

1) Soils developing in loamy material which has been weathered from consolidated sedimentary and basic igneous rocks on moderately steep to steep uplands and steep lower valley side slopes.

Soils of the Plains

1) Soils formed in material weathered from sandstones and shales on nearly level alluvial fans and terraces;

2) Soils developing in material weathered from shales on moderately steep to steep residual uplands;

3) Soils developing in loamy to clayey materials weathered from siltstones and shales on steep to very steep slopes in highly dissected badlands;

4) Soils formed in clayey and loamy materials weathered from interbedded parent rocks in dissected uplands, narrow low-gradient ridgetops and steep valley sideslopes;

5) Soils developing in clayey materials weathered from interbedded, steeply dipping sedimentary rocks.

Soils of the Alluvial Lands (Foodplains)

1) Youthful soils developing in highly stratified alluvial deposits on stream floodplains and low terraces

8.1.4.2. Impacts

The likely impacts of the proposed Colstrip Units 3 and 4 on the soil resource include the following:

1) Soil erosion and subsequent increase in sedimenttation occuring primarily during construction of the proposed facilities;

2) Removal from agricultural production of the soils on the immediate project site through construction of the proposed plant;

3) Increases of heavy metals and other toxic substances in the soil system because of emissions from the proposed plant;

4) Soil erosion, resulting secondarily from plant emissions which directly cause a reduction in vitality, productivity or diversity in the vegetation which tends to hold the soil system in place;

5) Altered land use capability or productive potential as a result of coal mining activities; and

6) Uptake, translocation and/or accumulation of heavy metals or toxic substances in plants and particularly in animals occupying the higher trophic levels.

The most important of the above appear to be the increased potential for soil erosion, accumulations of heavy metals and/or toxic substances and the direct impact of the coal mining on the soil resource. The sediment load in Armells Creek will be increased by the disturbance of the soil and vegetation during construction of the proposed plant. Any change brought about in the basic nature of the soil-plant system will have a corresponding influence on sediment yield. There are several existing man-caused sources of sediment in the watershed, including the town of Colstrip, highway and railroad rights-of-way, agricultural use of land, and the large areas occupied by spoil banks associated with current and historical coal extraction. The watershed has a naturally high sediment yield because of the steep slopes, impermeable and poorly developed soils, and relatively large amounts of barren ground found in the watershed. With careful design and implementation, the construction of the plant should not result in large increases of sediment in surface water.

The amount of sediment coming from the site could be reduced by several methods, including the following:

1) Seeding barren areas with plant species selected for their soil-binding characteristics as quickly as the slopes are brought to grade;

2) Rapid back-filling and compaction of fill materials around pipelines and the plant to minimize the length of time the site remains disturbed;

3) Development of sediment dams or traps around large areas of disturbed materials;

4) Intensive efforts at seedbed preparation, including fertilization and mechanical treatment to loosen or compact the surface soil to maximum seed germination and growth; and

5) Storage and application of topsoil to provide a better medium for plant germination and growth.

A major impact upon the soils in the area would result from deposition of substances emitted during operation of the proposed plant. Three basic types of substances are of concern--heavy metals such as lead and cadmium, other toxic substances such as selenium and fluorides, and the sulfur-containing compounds. The distribution of heavy metals into this environment is particularily serious in that these elements are generally held in the surface horizons and potentially can be incorporated into plant tissue; in this state they could be transferred and concentrated in animals making up the remainder of the food chain. The importance of other substances varies. Fluorides have a toxic effect on vegetation and animals but differ from heavy metals in that they are often leached from the upper portions of the soil system. Selenium can be toxic to plants and animals, but its movement and transformation in the soil system are poorly understood. There is growing concern about deposition of sulfur-containing compounds, particularily in the form of acid rain. Long term impacts could include lowering the soil pH or reaction which in turn would affect soil nitrogen accumulation and transformation and the availability of plant nutrients, and potential extent of these impacts, and the probability that they could develop at Colstrip, are unknown.

Some of the elements which would be discharged into the atmosphere would also be found in the ash ponds. Such elements include sulfur, fluorine, lead, mercury, and silicon. Major changes in soil, surface and ground

water chemical composition would occur if significant amounts of seepage from the ponds take place. No prediction can be made of the total impact on the soil system because the rate and concentration of the seepage and the degree of oxidation of substances in the ash pond are unknown. If careful attention is given to the design, construction, and maintenance of the facility, there will be minimal impacts from seepage.

8.1.5.2. Impacts (on Vegetation), p. 138

"1. Pristine Areas" should be altered to read "1. Relatively Clean Areas."

8.1.5.2., p. 139

In the fourth and fifth lines of the first complete paragraph in the first column, "An ever increasing acidity of precipitation..." should read "An increase in the acidity of precipitation..."

8.1.6.2. Impacts (on Wildlife), p. 145

In the first sentence of the only entire paragraph in the second column, delete all words and punctuation (", altering its natural flow regime.") following "...from the Yellowstone River". replacing them with a period.

8.2.2.1. Population Characteristics, p. 157 (Table 8-10)

Add a superscript "4" immediately following the word "Alternatives" below the title. Add at the bottom of the page, below footnote 3: "[4]Population estimates for 1980 and 1985 include base and direct population estimates. Construction-related population is not tabulated in these figures."

8.2.2.1., p. 158

The paragraph which begins near the botton of the first column

and ends in the second should be deleted and replaced with the following paragraph:

Second, the population projections derived for the construction personnel are tenuous, at best. Labor disputes, difficulty in receiving necessary construction materials, changing conditions in the labor market, and a host of other factors subject construction projects to radical changes in the size of their labor forces. The projection of 1,750 construction personnel in 1978 is approximately 150 men higher than the maximum projected by Bechtel in its manpower loading forecasts (Section 8.2.2.). However, if the Colstrip project experiences a growth in its construction labor force similar to that at the Bridger Power Plant in Rock Springs, Wyoming, then even 1,750 construction personnel will be an extremely low projection. For the Bridger Project, a maximum of 1,200 workmen was predicted, but 3,000 men were required ("Rock Springs, Wyoming" 1974). A similar phenomenon in Colstrip using the Bechtel estimate of approximately 1,600 construction personnel would indicate a 1978 peak of 4,000 men and a total construction population of 7,650. If the base and direct population of Rosebud County are added to this figure, the total 1978 peak population would be 16,150.

9.1. <u>The Trend Toward Higher Voltages</u>, p. 249

Add after the last sentence of the first partial paragraph in the second column: "BPA may desire one new 500 KV line from Hot Springs west and is preparing an impact statement for this addition."

9.1., p. 250 (Table 9-1)

In footnote 1, "conduction" should read "conductor".

9.6. <u>Engineering Alternatives for the Colstrip Project</u>, p. 256-258 (Figures 9-2, 9-3, and 9-4)

The following legend should be added to each of these three figures:

—— 500 KV LINES

—— 230 KV LINES

○ LOAD CENTERS

⇄ ELECTRICAL POWER FLOW IN MEGAWATTS

10.3.1. Audible Noise, p. 264 (Figure 10-4)

In the title, delete "AN", substituting "Audible Noise". Below the title, add: "N = number of conductors per phase".

10.3.2. Radio and Television Interference, p. 266

In the first column at the end of the short paragraph introduced by "Method II:", replace the final period with: "(test location and assumptions were different than in Method III)."

10.3.4. Mitigating Measures to Reduce Adverse Impacts of the Lines, p. 272 (Figure 10-7)

The lable "TIME UNITS" and accompanying numerals 1-7 on the x-axis of the graph should be deleted.

11.1.3. Soils, p.282

Delete Section 11.1.3. Soils, from its beginning on page 282 up to (but not including) the beginning of Section 11.1.4. Vegetation on page 287. Substitute for it the following section:

11.1.3. Soils

11.1.3.1. Inventory

The soils of the study area were delineated using factors of relief, climate, geologic structures, and geomorphic processes as guidelines. The soils units are described as follows:

Soils of the Mountains

1) Soils developing in material weathered from noncalcareous consolidated rocks; in material weathered from permeable limestone bedrocks on steep or very steep slopes containing rock outcrops;

2) Soils developing from material weathered from noncalcareous rocks other than granites on steep or very steep mountain slopes (in areas of higher precipitation than in #1); in material weathered from calcareous rocks in the Belt Group on steep to very steep mountain slopes; in material weathered from Boulder Batholith granites on steep to very steep slopes;

3) Soils developing in fine textured glacial deposits in steep mountain valleys and in material weathered from limestone bedrock on very steep mountain basins;

4) Soils developing in loamy or clayey material weathered from shales and siltstones in moderately steep to steep mountain basins;

5) Soils developing in loamy material weathered from consolidated bedrock on very steep alpine ridges and adjacent subalpine slopes.

Soils of the Foothills

1) Soils developing in loamy material weathered from sedimentary and basic igneous rocks on moderately steep to steep uplands and steep lower valley sideslopes;

2) Soils developing in gravelly alluvial deposits of tertiary age on nearly level to moderately sloping high benches, alluvial fans and steep escarpments; in loamy material weathered from sedimentary rocks on moderately sloping to steep plateaus and high

ridges; in clayey sediments and silty lacustrine deposits on nearly level benches and steep escarpments;

3) Soils developing in loamy material weathered from sedimentary rocks on steep to very steep hogback ridges;

4) Soils developing in gravelly alluvial deposits in high precipitation areas on nearly level to moderately sloping high benches and alluvial fans; in loamy or clayey material weathered from soft shales and siltstones on nearly level to moderately steep uplands.

Soils of the Plains

1) Soils developing in materials weathered from sandstones and shales on nearly level benches;

2) Soils developing in material weathered from shales on moderate to steep uplands;

3) Soils developing in material weathered from shales on steep to very steep and highly dissectd badlands;

4) Soil developing in loamy to calyey materials weathered from interbedded steeply dipping sedimentary rocks;

5) Soils developing in material weathered from interbedded sediments on well dissected uplands, narrow level ridgetops and steep valley slopes;

6) Soils developing on clayey material weathered from interbedded sedimentary rocks.

Soils of the Basins

1) Soils deveoping in stratified alluvial deposits on nearly level alluvial fans and high stream terraces; in sandy and gravelly glacial outwash deposits on nearly level outwash terraces, fans, and steep terrace

escarpments; in silty alluvail fans and stream terraces;

2) Soils developing in volcanic-ash-capped glacial till deposits on moderate to steep uplands.

Soils of the Alluvial Lands

1) Soils developing in highly stratified alluvial deposits on stream floodplains and low terraces;

2) Soils developing in highly stratified alluvial deposits on stream floodplains and low terraces with significant areas of shallow water tables.

11.1.3.2. Impacts

A. Impacts of Soils on Transmission Lines

The nature of the soil must be considered in the right-of-way selection for the transmission line. For example, soils developing in rough broken areas will generally be shallow and susceptible to erosion following any kind of disturbance. Those areas are less suitable for transmission line rights-of-way because of the high cost of road construction and the degree of environmental disruption created in their construction. Similarly, areas underlain with hard rock at or near the surface or very steep slopes also have these limitations.

The hazard of slope failure and mass movement, presence of high shrink/swell clays, and high water tables are soil factors placing severe limitations on the placement of towers because of the high cost of construction in these areas and the degree of environmental damage which results. Some of these constraints can be overcome or at least mitigated by careful corridor selection and tower placement and by adhering to proper construction methods.

B. Impact of Transmission Lines on Soils

Distribution of the soil mantle results in varying degrees of erosion, depending on the nature and severity of the disturbance

and the inherent erodability of the soil. Man's activities often disrupt the dynamic equilibrium of the soil system and initiate or accelerate the natural erosional process. In evaluating this project, erosion will be considered significant when it results in lowered on-site productivity to the extent that efforts to restore a site to its predisturbance state are impaired or if there is a high probability that eroded material will move into surface waters, lowering off-site water quality.

The impacts of transmission line construction, operation, and maintenance on the soil resource are important factors to consider for this impact statement. There are four aspects of transmission lines that will have an impact on soils.

1. <u>Location and Construction of Tower Foundations</u>

Since the physical presence of a tower will not cover a large area (30 feet square or 110 feet square, depending on tower type), the effect on site productivity is slight. However, construction and tower erection activity in the area surrounding the foundation can be significant. The impact on productivity and subsequent reclamation efforts will range from slight to severe, depending on the revegetation potential of the soil.

2. <u>Location and Construction of Access Roads, Staging Areas, Storage Areas, and the Area Around the Foundation During Erection of the Towers</u>

Access roads and staging areas would create the most significant impacts on the soil resource during the construction phase. Construction of roads will distrub soil over the largest total land area and have the greatest total impact, resulting in the loss of productivity and the off-site sedimentation of surface water. Careful construction and location of the roadways can minimize this impact in many areas. Staging areas have the same impacts as roads but occupy larger single spaces over scattered areas. They potentially could lead to larger impacts than the road system.

The likelihood of the construction and use of access roads and staging areas generating sedimant pollution of downslope

surface waters is a function of:

1) Erodability of materials occupying the area;

2) Steepness of the slope;

3) Length of time the soil surface remains bare of protective vegetative cover;

4) Proximity of the disturbed area to surface drainage channels;

5) Season in which distrubance occurs;

6) Nature of plant materials used to revegetate the area;

7) Occurrence of high intensity precipitation or spring runoff;

The long-term effects can be reduced by practices such as reseeding, draining, and location procedures which avoid erosive soils and surface drainage channels. The short-term risks during and shortly after construction are largely unavoidable. Soil characteristics that limit suitability for roads and staging areas are those that limit revegetation potential for erosion control plantings and reclamation. Trafficability, relative to intensity and season of use, would result in erosion, associated sedimentation risk, and loss of site productivity. Movement of heavy equipment through mountainous areas could possibly have a tremendous erosion impact in some areas.

3. Electrical Characteristics of the Line

The impact of the electrical characteristics of an operating line on the soil immediately under and around the line is difficult to estimate without futher study. Research is needed prior to making any definitive assessment of the nature and extent of impacts on the soil resource by the operation of the proposed transmission line.

4. Permanent Roads for Maintenance and Emergency Repairs

The roads needed for maintenance and emergency repairs, after initial construction, will be stabilized, drained and reseeded (Westinghouse 1973). The most important considerations for soils are the season of use and the type of equipment. Movement of heavy equipment through mountainous areas during the spring runoff period can be regarded as an extreme but realistic possibility which would have a tremendous erosion impact in some areas.

11.1.4.2. Impacts (on Vegetation), p. 289

In the second column, delete the first sentence of the last paragraph, substituting "The above studies indicate that it is unrealistic to say that a given concentration of ozone will not cause damage to vegetation."

11.1.4.2., p. 290

In the second line of the first column, "O_2" should read "O_3".

VOLUME 2: Methodology, Need and Alternatives

1.2. Methodology, p. 9 and Chapter Three, Methodology, p. 26

Reference was made in Volume 1, Summary, and in Volume 2, Methodology, Need and Alternatives, that the basis of need for the proposed facilities is derived, in part, from the legal interpretation of need under the Utility Siting Act, and that a request for this interpretation had been made to the Attorney General. Legal research completed by counsel for the Department made it clear that it was not necessary to obtain an opinion on the interpretation of need from the Attorney General on this question. Therefore, the request was withdrawn.

The basis of need to which the Utility Siting Act refers is primarily that of the citizens of the State of Montana, and most importantly looks within the State of Montana. However, one of the general considerations which the Department has studied is described as "energy needs," and that consideration is not limited to the State of Montana alone. The Department has not given priority to intrastate needs over the needs of its neighbors. Although the legislative history behind the Utility Siting Act suggests that it was the needs of the citizens of the State of Montana, within the state boundaries, which were of primary concern to the legislature, both general case law and overall constitutional interpretation impose the general burden which the Department has accepted: "energy needs" are inclusive of citizens and areas outside of this state.

4.2.4.2. Projections for the Applicant Companies, p. 49

In the first line of the first complete paragraph in the second column, "38.13 MW" should read "3813 MW".

4.3.1.1. Population Growth, p. 65

In the fifth line from the bottom of the first column, "million standard cubic feet)" should be inserted after "MMscf".

4.5.1. Projected Consumption Compared to Present and Projected Capability, p. 74

After the first complete paragraph, insert the following:

The Department does not possess adequate information from the applicants concerning plans for joint use of power from Units 3 and 4 with energy intensive industries, or other activities which might utilize the waste heat from the facilities. The Department will study such information as it becomes available.

4.5.1.1. Montana Power Company Consumption and Capability, p. 80 (Table 4-14)

In the first note following the table, "as of 12-31-72 + 1,882 MW" should read "as of 12-31-72 = 1,882 MW".

4.5.1.2. Montana Power Company Estimates,

The load projections done by MPC are based on the experience of company loads for the period from 1952 to 1971. Total load figures are used, so that line losses are included in the data. Sales to other utilities and energy wheeled for other utilities are excluded; the figure used are essentially the energy load for which MPC is responsible. In Table A these 19 years of data are shown together with the three most recent years. As can be seen there, the total load figures essentially parallel the figures shown in previous tables; total growth has been very slow. Between 1952 and 1974 the MPC total load growth was at an average annual rate of only 2.64%.

This low growth rate in total load has been divided into two segments by MPC. The first segment is the block-load customers served by the company, made up mostly of large industrial customers and specially designated customers. These block loads are subtracted from the total load to yield the second load segment, the "base load." The base load is made up of the residential, commercial, and small industrial customers. The reason for breaking the load up in this way is the differing behavior

TABLE A

MPC ACTUAL LOADS 1952-1974
Average Megawatts

Year	Actual Total Load	Actual Base Load	Actual Block Load[1]
1952	338	152	186
1953	331	146	185
1954	294	149	145
1955	353	169	184
1956	382	185	197
1957	367	179	188
1958	350	186	164
1959	309	197	112
1960	359	210	149
1961	376	230	146
1962	392	235	157
1963	400	250	150
1964	437	268	169
1965	467	283	184
1966	508	301	207
1967	467	319	148
1968	496	336	160
1969	543	348	195
1970	564	366	198
1971	560	398	162
1972	589	424	165
1973	578	447	131
1974	600[2]	463[2]	137[2]

[1]Actual Total Load Minus Actual Base Load. Calculated by the Department of Natural Resources.
[2]Preliminary

Source: Gregg 1975

characteristics of these two groups of load through time. The base load has been growing smoothly through the 22-year period, whereas the block-load segment has shown much more fluctuation. Over the 22-year period the base load has grown at an average rate 5.2%; at the same time the block load has decreased a total of 26% between 1952 and 1974. Much of this loss in block loads is attributable to the termination of the Anaconda Company zinc operations in 1972. The zinc operations had been averaging 60 MW of energy between 1960 and 1971.

MPC load projections begin by projecting the base load into the future at the historical rate of growth. This growth rate is derived from a least-squares fit of an exponential curve to the base-load data for the 1952-1971 period and is equal to 5.5%. Estimated block-load figures are then added to the projected base-load figures to derive the total load figures. Estimates of the future block-load portion of total load are made from analysis of each individual block-load.

This method of load forecasting does not explicitly consider underlying economic and demographic variables. Discussion of future loads with block-load customers should bring some economic variables implicitly into consideration, at least as the block-load customer interprets the future. The base-load projections are entirely a function of past history, and they will probably remain that way until the actual base load deviates strongly from the base-load projection.

As was discussed in the draft statement, we may be at a point in time where the experience of the past is not a good indication of the future. There seems to be a general movement in the Northwest to revise previous forecasts of load downward, since actual loads have fallen short of predicted loads over the past few years.

Total load for MPC was between 2% and 3% below the forecast amount in 1973 and 1974. This was due to a short fall in the block loads. Growth in the base load since 1970 has, on the average, been above the historical trend, but the growth from one year to the next has fallen off in each of the last four years. It is probably still too early to put much weight on this decline in growth.

The resulting firm load estimates are shown in Table B below. This table shows figures substantially larger than those shown in Tables 4-3, 4-12 and 4-13 in the draft statement. There are two reasons for this increase: 1) the figures in the draft represent sales to ultimate customers as shown in FPC Form 1; they do not include sales to the Flathead Irrigation Project or system line losses; and 2) the rate of growth used in the projections in the draft impact statement is substantially lower (3.51%).

TABLE B

MONTANA POWER COMPANY
ADJUSTED FIRM LOAD ESTIMATES
Calendar Year Basis

Year	Average	Peak
1975	662	1007
1976	711	1050
1977	748	1116
1978	800	1184
1979	837	1239
1980	875	1297
1981	913	1359
1982	954	1423
1983	998	1491
1984	1044	1562
1985	1081	1638

Source: MPC 1974a

Table C is a summary of loads and resources projected for MPC through the operating year 1986-87. This table is based on Exhibit I of the MPC Long Range Plan, with the adjusted firm load figures coming from more recent estimates. All resource figures assume all four Colstrip units are brought into service on schedule. In this table, the first row represents available

Table C

MONTANA POWER COMPANY
LOAD AND RESOURCE SUMMARY

	1974-75 PK	1974-75 AV	1975-76 PK	1975-76 AV	1976-77 PK	1976-77 AV
Resources - Critical Water	1035	639	1122	692	1191	812
Adjusted Firm Load	912	621	1007	697	1050	726
Surplus or (Deficiency)	36	-	(17)	(26)	(12)	56
Reserves Included	87	12	132	21	153	30
Maintenance Included	0	12	0	31	8	43
Interruptible	21	18	21	19	24	20
Median Water Adder	-	48	-	48	-	50
Bird Included	70	6	70	12	70	18

	1977-78 PK	1977-78 AV	1978-79 PK	1978-79 AV	1979-80 PK	1979-80 AV
Resources - Critical Water	1191	855	1402	1030	1614	1232
Adjusted Firm Load	1128	778	1184	819	1239	856
Surplus or (Deficiency)	(90)	47	33	169	158	322
Reserves Included	153	30	185	42	217	54
Maintenance Included	8	39	8	43	8	58
Interruptible	25	21	26	22	28	23
Median Water Adder	-	51	-	51	-	51
Bird Included	70	12	70	15	70	20

Table C cont. etc.

	1980-81 PK	1980-81 AV	1981-82 PK	1981-82 AV	1982-83 PK	1982-83 AV	1983-84 PK	1983-84 AV
Resources - Critical Water	1648	1323	1648	1331	1649	1326	1649	1327
Adjusted Firm Load	1297	894	1359	934	1423	977	1491	1022
Surplus or (Deficiency)	134	375	72	343	9	295	(59)	251
Reserves Included	217	54	217	54	217	54	217	54
Maintenance Included	8	64	8	54	8	62	8	62
Interruptible	29	24	31	25	32	27	34	28
Median Water Adder	-	51	-	51	-	51	-	51
Bird Included	70	23	70	20	70	23	70	23

	1984-85 PK	1984-85 AV	1985-86 PK	1985-86 AV	1986-87 PK	1986-87 AV
Resources - Critical Water	1649	1327	1650	1328	1650	1328
Adjusted Firm Load	1562	1068	1638	1117	1718	1169
Surplus or (Deficiency)	(130)	205	(205)	157	(285)	105
Reserves Included	217	54	217	54	217	54
Maintenance Included	8	62	8	62	8	62
Interruptible	36	30	38	31	40	33
Median Water Adder	-	51	-	51	-	51
Bird Included	70	23	70	23	70	23

1. Resources assume critical water with maintenance deducted. All Colstrip generation is included and is "on time".
2. Adjusted Firm Load is from RCS 11/1/74 Adjusted Firm Load Forecast.
3. Median Water Adder includes adjustment for Great Falls; also for Thompson Falls until tainter gates are installed.
4. Average energy includes energy from Bird only when Corette and Colstrip Units are down for scheduled maintenance.

Source: MPC Long Range Plan with adjustments from MPC Adjusted Firm Load Estimate 11/1/74

resources with critical water conditions assumed. The available resources figure is the net of a deletion for scheduled maintenance of generating units.

The second row is the adjusted final load, which includes sales to customers that MPC is responsible for serving plus line losses. These figures are comparable to those in the previous table, except that here they are on an operating year rather than a calendar year basis.

The third row gives a measure of the ability of resources to meet loads. It includes consideration of reserve requirements. It is calculated by subtracting both the adjusted firm load and the larger of either reserves or interruptibles from the resources.

The fourth row is MPC's estimate of desired reserves and is related to type and size of units and load magnitudes.

The fifth row from the top is the estimated generation lost due to scheduled maintenance of units.

The interruptible service estimated in the sixth row is not considered a part of the firm load since the company is obliged to provide such service only if the power is available. There is no obligation to serve this load if resources are needed elsewhere.

The next column is the addition to critical water resources that would occur if instead of critical water, medium water conditions existed in that year. Critical water assumptions are based on the worst water conditions that can reasonably be expected.

The last row is the amount of generation of the Bird plant that is included in the resources (row 1) figure. The Bird plant is the most expensive to operate in the entire system, and the only oil-fired unit.

5.2.1. <u>Nuclear Fission Power Plants</u>, p. 81

In the second and third lines of the first paragraph, "(the amount of power proposed for Colstrip)" should read "(the amount

of power proposed for both Colstrip Units 3 and 4)".

5.2.1., p. 81

It has been accurately commented that the turbine, generators, and containment vessel of nuclear fission power plants need not be located over very firm bedrock, as stated in the first paragraph of this section. However, if not, special design must be employed and special preparations undertaken to ensure that proper foundations are set for these massive items.

The discussion of thermal efficiency and plant utilization in the first complete paragraph on page 82 was not intended to imply a dependence of one factor on the other. All large base-load units, nuclear or fossil, are run as nearly at full load as possible. To do otherwise is uneconomical.

5.2.2. <u>Hydroelectric Power Plants</u>, p. 82

The second paragraph of this section is not intended to imply that no construction problems are encountered with hydroelectric power plants. Problems and delays are encountered in all types of power plant construction. There are problems, however, that are unique to the construction of nuclear units.

5.2.2., p. 83

In the next-to-last line of the first complete paragraph in the first column, delete "destroyed" and substitute "significantly altered".

5.2.3. <u>Coal-Fired Power Plants</u>, p. 83

The first paragraph of this section states that firm bedrock is required for construction of coal-fired units. As mentioned in the comments on Section 5.2.1. above, this is not strictly the case; if bedrock is not utilized, though, special design and foundation preparations are required.

5.2.4. Gas/Oil Turbine Units, p. 84

It has been commented that the electric remote control systems used in these units are incorrectly linked with maintenance problems. The problems arise not from the remote control systems themselves, but from the way in which the turbines are employed.

5.2.5. Geothermal Power Plants, p. 85

The geothermal site at Marysville, Montana, has been abandoned as a possible power plant source because of the unexpected presence of water during the exploratory drilling. Evidently underground water sources caused the suspected temperature gradients to decrease significantly.

5.2.7. Solar Power, p. 86

At the end of the first complete paragraph in the second column, add this sentence:

"Another direct conversion system currently being investigated and researched is the ground-based photo-voltaic solar installation."

6.1.2.2. Cost Comparisons, pp. 102-4 (Table 6-7)

In the title (found on each of the three pages), "Transmission Estimate 1" should read "Transmission Estimate A".

6.1.2.2., p. 107 (Table 6-8)

The heading of column (7), "($2.25/MWH Table 6-1)" should read "($7.25/MWH Table 6-1)".

6.1.2.2., p. 117 (Table 6-11)

The title, Transmission Estimate" should read "Transmission Estimate E".

6.1.2.2., p. 121 (Table 6-12)

In the title, "Transmission Estimate" should read "Transmission Estimate F", and Assumed Investment of 206,273.8," should read "Assumed Investment of $206,273,760".

6.1.4.1. Reconstruction of the Applicants' Analysis, p. 137 (Table 6-18)

In the first column, the sixth line should read "1.536" rather than "1526".

6.1.6. Cost Calculations With MPC Figures, p. 141

Montana Power Company has commented that the Department has used very high per mile estimates of transmission construction costs. MPC suggests that the estimated cost should be $152,220 per mile. However, additional materials substantiating the figures and calculations used to derive these estimates were not given to the Department. Therefore, the suggested lower cost cannot be considered valid at this time.

6.1.7. Diesel Fuel Consumption

The national consumption of distillate fuel oil in 1974 was 1,124,358 x 10^3 barrels per year. The term distillate fuel is commonly applied to diesel fuel and the light fuel oils used for residential heating. Twenty-five to 30% of refined petroleum products may accurately be termed distillate fuels. It has been calculated that unit trains carrying coal from Colstrip to Spokane would consume 26.2 million gallons of diesel fuel per year (i.e., 0.6 million barrels per year). This is approximately 0.05% of the national consumption.

6.1.8. Comparative Energy Cost

Another way of comparing the costs of coal shipment with transmission costs is to contrast the relative energy expenditures necessitated by each transport method. In Figure A the approximate operating cost in terms of BTU's expended are compared.

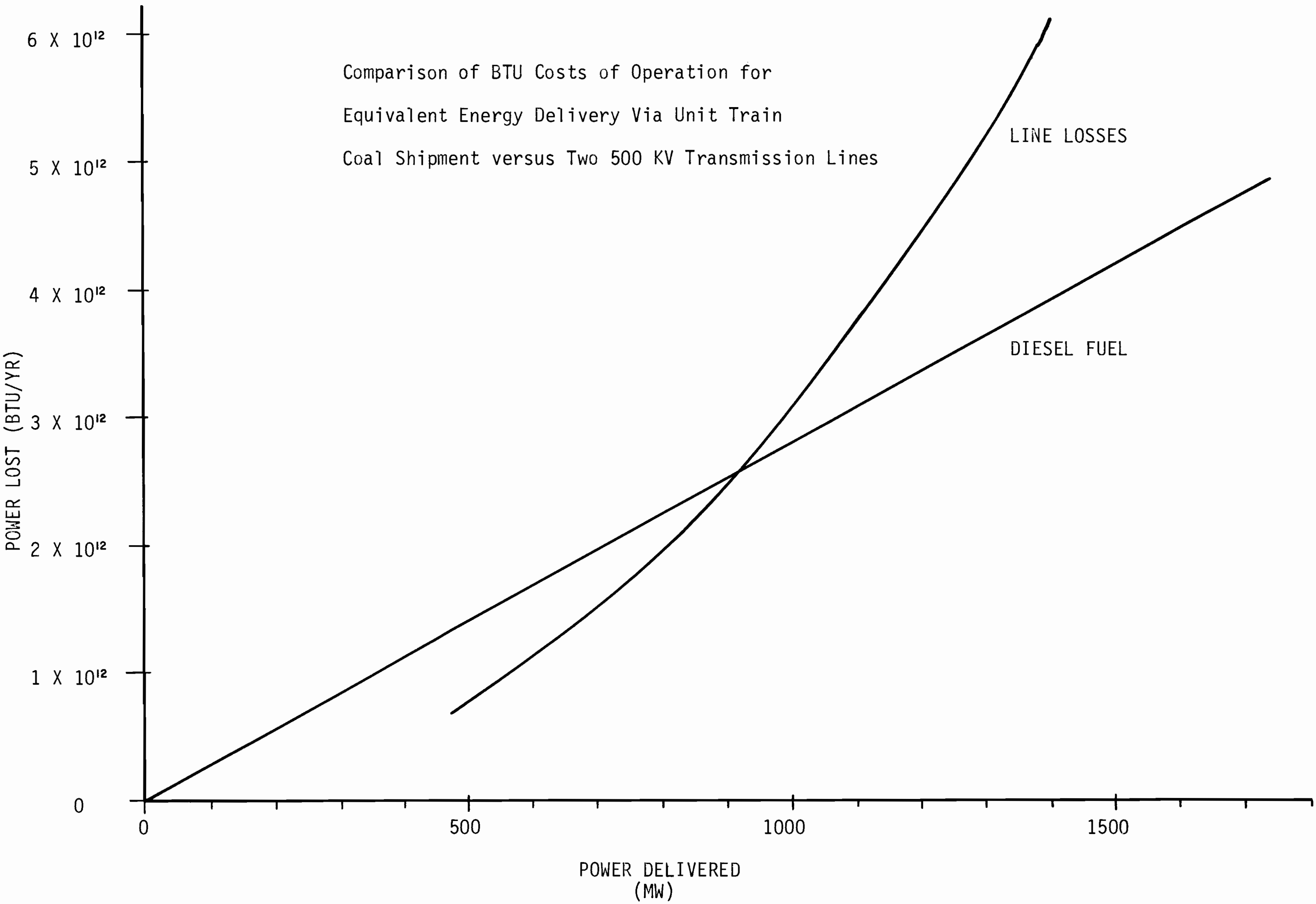

Comparison of BTU Costs of Operation for
Equivalent Energy Delivery Via Unit Train
Coal Shipment versus Two 500 KV Transmission Lines
LINE LOSSES
DIESEL FUEL
POWER LOST (BTU/YR)
6 X 10¹²
5 X 10¹²
4 X 10¹²
3 X 10¹²
2 X 10¹²
1 X 10¹²
0
0
500
1000
1500
POWER DELIVERED
(MW)

FIGURE A

Both coal transport and transmission are for a Colstrip-to-Spokane routing.

The line depicting BTU expenditures from diesel fuel consumption relates the delivered energy and BTU expenditure if the coal is shipped by unit train from Colstrip and converted to electrical energy in Spokane.

The second line shows the relationship between line losses and delivered load. This relation is for the proposed 500 KV transmission lines between Colstrip and Spokane. The BTU expenditure is based on the thermal input (coal) at Colstrip required to generate the electrical energy lost in transmission.

For example, if 1400 MW of electrical energy were to be delivered to Spokane from Colstrip by twin 500 KV transmission lines, the "Line Losses" line shows that losses would be 6.051 x 10^{12} BTU's per year. The "Diesel Fuel" line shows that shipping the coal required to generate 1400 MW from Colstrip to Spokane via unit train would result in a loss of 3.942 x 10^{12} BTU's per year. This is 2.109 x 10^{12} BTU's less than is lost by transmission line.

7.1.1.6. <u>Dry Cooling Tower</u>, p. 161

In the eighth line of the first complete paragraph in the first column, delete "2.5^{0}F" and substitute "25^{0}F".

VOLUME 3a: Power Plant

8.3.1. Analytical Data, p. 200

In the first column, delete the last sentence of the first paragraph. Substitute for it:

Twenty randomly selected samples from the 15 cores taken in areas C, D, and E, including part of the samples analyzed by USBM, were further analyzed by the Montana Department of Health.

Sample Number			% Sulfur (as received basis)
N37	E26.5	2R	0.90
N37	E26.5	3R	0.45
N37	E26.5	4R	0.45
N38	E36.5	3R	0.23
N42	E20.5	4R	3.0
N45	E67	1R	0.90
N45	E67	3R	0.30
N45	E15.5	3R	0.45
N46	E64	5R	3.0
N47.5	E34	2R	0.45
N47	E26.5	3R	0.45
N47	E26.5	4R	0.53
N47.5	E34	3R	1.43
N47.5	E34	5R	0.45
N55	E62.5	5R	1.73
N62	E62.5	1R	1.20
N62	E62.5	2R	0.68
N62	E61.5	3R	0.38
N62	E62.5	4R	1.05
N62	E61.5	5R	0.83

Mean = 0.95 % S

8.3.1., p. 200

In the second column, thrid paragraph, third line, "4.5 x 109 yrs" should read "4.5 x 10^9 yrs". In the fifth line, "2.5 x 105 yrs" should read "2.5 x 10^5 yrs".

8.4.4.2. Description of Control Efficiencies, pp. 217, 218 (Figures 8-17, 8-18)

Corrections have been made on both of these figures. They have been reprinted correctly on the following pages.

8.4.4.3. Trace Element Emission Rates, p. 221 (Table 8-6)

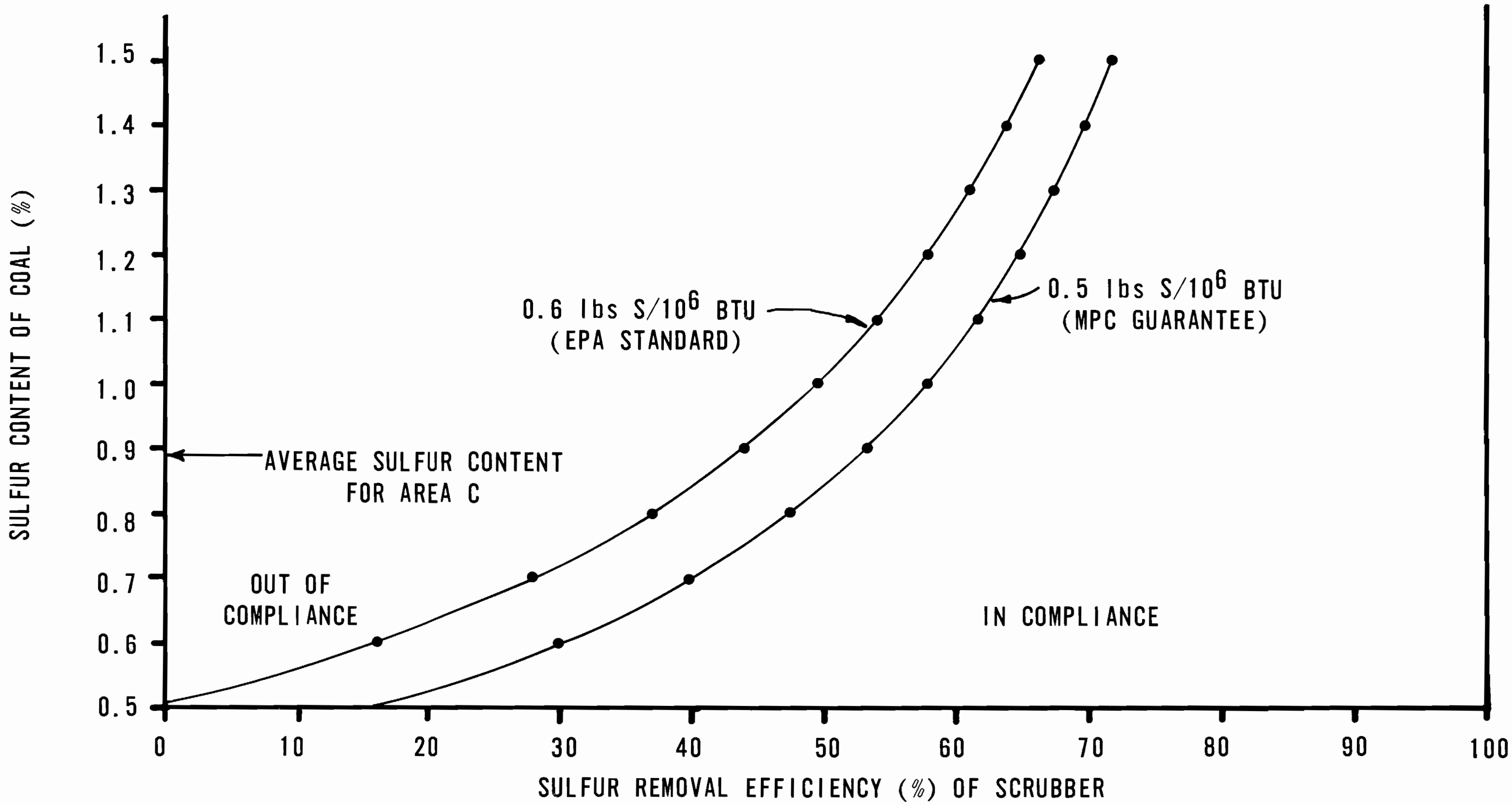
In the last column (under "100% Cap Emission Rate g/sec"), opposite "$_{226}$Ra (radium)", "Ci/hr" should read "Ci/sec". In the first column, near the bottom of the page, "sarmarium" should read "samarium". On page 222, in the first column,"ytterium" should read "yttrium".

8.5.1. Plant Water Analysis, p. 238 (Figure 8-27)

The applicants have questioned the Department's use of the figure of 30,410 gpm (gallons per minute)as the maximum summer withdrawal from the Yellowstone River in Figure 8-27, "Summer Water Budget for Surge Pond." That value was taken from the Applicants' Environmental Analysis (Westinghouse 1973), Figure 2.3-5, "Overall Water System for the Plant." The Department was informed by the applicants during the writing of the draft impact statement that the Applicants' Environmental Analysis contained the best available data.

9.3. Reclamation Method, p. 267

In evaluating efforts at reclaiming strip mined land in eastern Montana and throughout the country, the capability and the sustained productivity of the land must be considered. The land capability designation is related to the characteristics of the soil system and their integration to serve as a media for plant growth which can be utilized by man. Soil characteristics

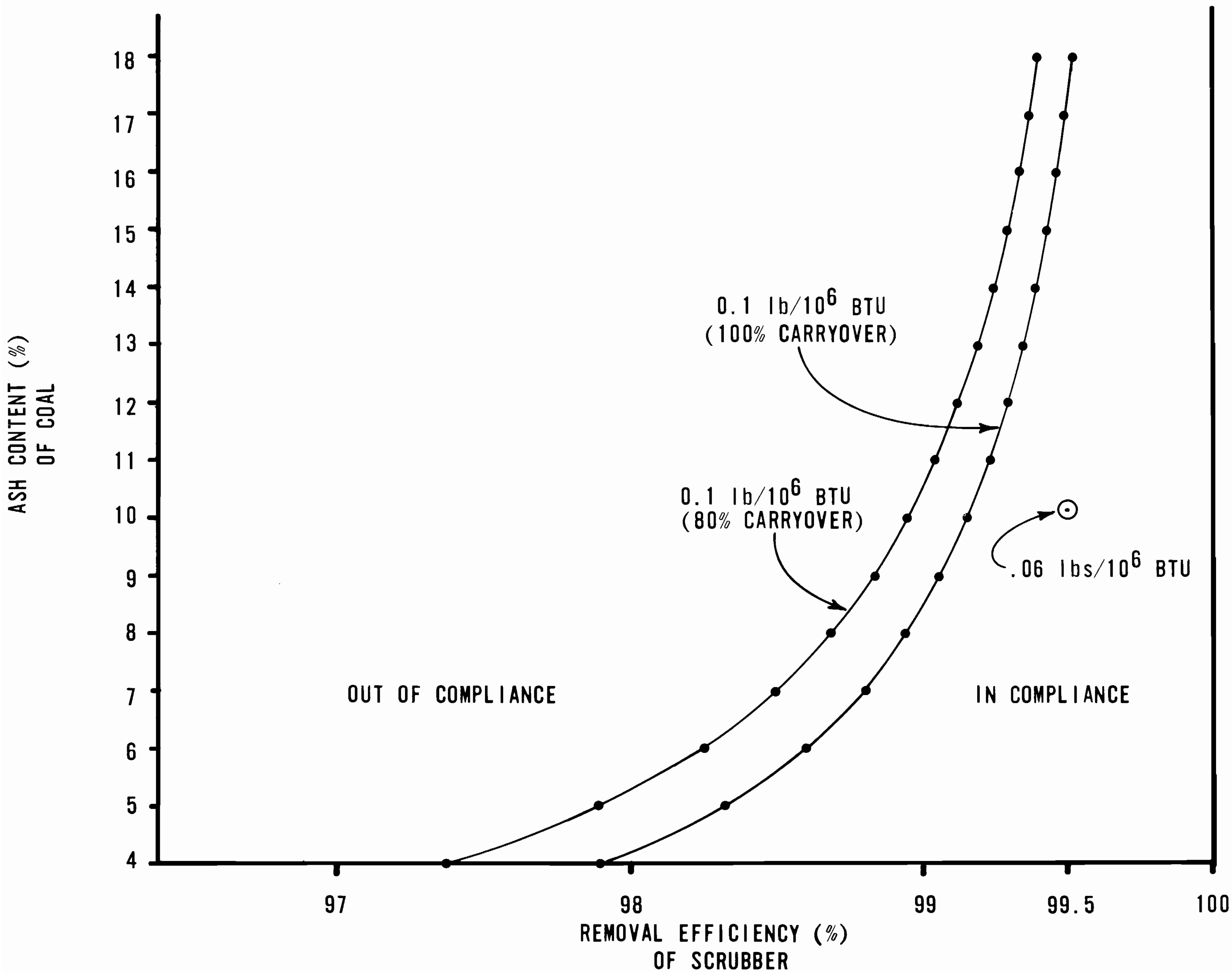


NOTE: 1.0 lb S=2.0 lb SO_2

Curves shown on this graph correspond to 1.2 lbs SO_2 and 1.0 lbs SO_2

REMOVAL EFFICIENCY TO ACHIEVE COMPLIANCE WITH SULFUR EMISSION STANDARDS
AREA C COAL (8383 BTU/lb)

FIGURE 8-17



REMOVAL EFFICIENCY TO ACHIEVE COMPLIANCE WITH PARTICULATE EMMISSION STANDARDS
AREA C COAL (8383 BTU/lb)
FIGURE 8-18

and land classification are definable entities, only some of which can be adjusted to alter the potential use of the land. One example of the relationship of land capability to the rehabilitation problem involves the reclamation of a mined area which previously supported a range plant community. The land might well have been suited to cropland production but in pre-mining history was used, less intensively, as rangeland. To return the land to its original state would require mitigation to the point that dryland crops might be grown.

Productivity is generally defined by the amount of plant or animal matter (biomass) produced per unit time per area. The existing land capability classification system used in the U.S. has four general land capability classes suited to cropland production- Classes I through IV. Most of the land area of eastern Montana being cultivated is Class II through IV. Class I lands are generally more productive than the Class IV areas. Soil fertility levels are not among the soil characteristics used to define land capability, but are important in terms of land productivity. If land is to be reclaimed to approximately its original condition, then both capability and production must be considered in evaluating the success of the effort.

There are no long-term studies evaluating the sustained productive levels of either row crops or forage on reclaimed lands in the western part of the U.S. The problems faced in reclamation/ rehabilitation of surface-mined lands in this area are severe. Some of the most serious limitations to reclamation in the Great Plains are listed as follows:

1. There is a general lack of available soil moisture resulting from limited total precipitation or the unavailability of existing moisture by its interaction with clays and/or soluble salts.

2. Wide seasonal and annual precipitation fluctuations and other climatic variation which characterize the Great Plains place great physiological stresses upon the developing vegetation in areas being reclaimed. This

is compounded by the substrate being largely different from the native soil systems to which the plant species have become adapted.

3. The fill material or substrate which is being reclaimed will weather and be otherwise altered to form a soil very slowly. The environment of eastern Montana and the remainder of the Great Plains is such that the formation of soil takes place slowly, i.e. over a time frame of centuries, not years.

4. There is a general shortage of seed for native plant species from local sources in eastern Montana. Use of seed from the local area in reclamation is important because there are demonstrated ecotypic differences within many important native species. A second aspect related to the problem of reproducing native species is that several important species do not produce usable seed and will only reproduce vegetatively. Recent studies on hydroseeding of vegetative materials indicate that this portion of the problem may soon be overcome.

Hodder and Sindelar's work (Hodder et al. 1972, Sindelar et al. 1974, Sindelar et al. 1973) at Montana State University (MSU) and Sandoval's studies in North Dakota (Sandoval et al. 1973) represent the kinds of research efforts being conducted in the Great Plains in the area of surface mine land reclamation or rehabilitation. The MSU studies have largely been conducted in the Colstrip and Decker areas of Montana. These research efforts have been undertaken within the last 5 to 8 years, and therefore no long-term results are available.

Significant recovery, measured by the amount of plant production (biomass), has been possible in several areas in Montana, Wyoming and North Dakota, although the level of production varies widely with fluctuations in total precipitation and its distribution throughout the year. Detailed studies, with rigorous

experimental control for comparative purposes, have only rarely been undertaken in studying reclaimed areas. A question exists as to the permanence of the vegetation cover in the high plains region, particularily in light of the wide seasonal and annual climatic fluctuations. The diversity and stability of the vegetation which has been established has not been included in many studies.

The reclamation research efforts in the west have taken two basic approaches: 1) selection of adapted plant species which are capable of growth on relatively unaltered spoil material, and 2) chemical and physical alteration of the spoil. Sindelar and Hodder have had some success in reclamation through mine preplanning, adapted species identification and the leveling and development of water-holding surface features. The costs are in the range of $300 to $800 per acre and are largely dependent on the nature and amount of spoil movement required.

The most sophisticated rehabilitation efforts involve the more intensive forms of agriculture through the production of row crops such as wheat, corn, and soybeans. Only small percentages of the total land surface mined in the U.S. are ever returned to this type of use. This is generally done for demostration purposes in locations where large visitor groups have ready access. The technical capacity to carry out the effort exists for most locations, but the determination and desire to do so have been lacking to date and as a result the costs are then externalized to society instead of being a part of the cost of the coal. Frequently, this advanced type of reclamation involves extensive preplanning and leveling operations, storage of soil or fill material which has been carefully selected for its capacity to support plant growth, and the application of activated sewage sludge or other organic materials.

The introduction of sewage sludge would have a strong stimulatory action on the microorganisms contained in the fill material undergoing reclamation. An unknown amount of the sludge would be converted to soil organic matter, resulting in an increase in water-holding capacity. Cation exchange capacity,

which is generally related to overall soil fertility, would be increased. The increased amounts of soil organic matter would tend to stimulate the formation of soil structure.

The limitations to the process of sludge incorporation include the cost, in both dollars and BTU's of energy, to transport the material from the large municipalities to the reclamation site and the occurrence of heavy metals in the sludge. The transportation costs would be high because of the distances tetween Colstrip and the large urban areas of Denver, Spokane, Minneapolis-St. Paul and Chicago.

Heavy metals such as lead, cadmium, etc., frequently occur in sewage sludges because of the lack of pretreatment of industrial wastes prior to discharge into sanitary sewers. Significant reductions in the amount of discharge are technically feasible at this time through adequate pre-treatment. These metals, in general, are relatively insoluble in the pH 7.0 to 8.5 range found in most fill material selected for reclamation purposes. As a result, they would be bound in the upper portions of the soil system. They are a serious threat in areas characterized as having high sulfur/low pH because they do become soluble under these conditions. The solubility is important in that uptake by plants can then occur, and the metals then enter the food web of the surrounding environment. Serious thought should be given to any decision about the application of sludge because, once these metals have found their way into the soil system, the area must from that point on be managed differently than corresponding areas lacking the metals. The quantity, distribution and concentration of the sulfurous/sulfuric acid deposition on the soil system from plant gases would also be important. These substances have the capacity to induce relatively rapid change in soil pH under certain circumstances and subsequently affect metal solubility. The rapidity and scale of these potential soil pH changes are not known at this time.

Some of the surface-mined land in Germany has been reclaimed to row crop use (Nephew 1972) with crop production levels reaching or exceeding pre-mined levels within five years. This has

been accomplished in an area where aeolian (wind-blown) deposits constitute a sizable part of the overburden. These materials, a rather productive media for plant growth, are pumped in a slurry form back onto the disturbed and leveled site, and activated sewage sludges are incorporated into the surface. The costs of these efforts are high, and no large-scale trial of this type or level of reclamation has been made in the U.S. The nature of the overburden and type of environment associated with this site also play a significant role in the selection of the level of rehabilitation to be attempted.

The reclamation of surface-mined lands to cropland capability has not been pursued in Montana. Limited reclamation experience in the moister midwestern portions of the United States has yielded higher levels of forage production than would occur on native rangelands. These efforts have involved primarily alfalfa-grass-hayland, and some large areas have proven to be satisfactorily productive over extended periods of time. Unfortunately, only a small percentage of the land area being surface mined is returned to these more productive levels. The Amax-Meadowlark Farms system has been a leader in this effort ("This Is Meadowlark Farms" undated). The resultant vegetative cover has proven to be stable and has produced sizable economic returns to the company. Because careful production records have not been made available, comparisons with pre-mined levels of production cannot be made. Additional costs, 4-to 8-fold increase, in cultivating or harvesting these lands have been encountered through damage to equipment. Therefore, one must consider all factors in attempting to evaluate the effectiveness of reclaiming these lands.

The costs of reclamation vary widely depending on the level of preplanning undertaken, objectives of the rehabilitation effort, the type of mining and nature of equipment being used, and the nature of the overburden materials. The average costs of reclamation range from \$300 to \$800/acre in the Great Plains to \$1,000 to \$1,500/acre in the Midwest ("This Is Meadowlark Farms" undated). Some available figures for West Virginia indicate that \$450 to \$1,000/acre might approximate the average being spent. The West German efforts are costing \$3,500 to \$5,000/acre

(Nephew 1972). The total cost of reclamation cannot be simply evaluated in terms of comparative land costs. High-quality reclamation can result in the following positive resource and socio-economic benefits:

1. Rehabilitation of lands to a level enabling them to be utilized to produce food--a commodity available in increasingly short supply.

2. Reduction of the external costs (those not relected in the price of the coal) such as sedimentation of streams and increased particulate matter in the atmosphere.

3. Aesthetic and physchological benefits to people of local communities derived from the existence of productive land rather than acres of strip mined fill ridges.

A question inherent to a discussion concerning reclamation is that of the potential redevelopment of a soil system somewhat similar to that destroyed by surface mining. Some soils in the high plains of Montana and Wyoming apparently have developed under moister climate regimes than are now present. These soils are more intensely weathered and exhibit greater change by soil-forming factors than would be found in soils developing under today's climatic regime. There is a possibility that these soils do have a greater productivity under the existing climatic conditions than recently formed soils. Therefore, the destruction of this resource is an irretrievalbe loss. Man cannot, within reasonable terms, reconstruct this system, and the loss of these soils would be translated into an overall loss in regional agricultural productivity.

A series of questions must be addressed when evaluating the success of any reclamation effort. Some of these include:

1. What is the capability of the reclamation to confine the environmental insult to the actual area surface mined?

2. What is the potential land use capability of the surface material after reclamation, and how does this relate to the pre-mine soil system?

3. What is the sustainable productive potential or carrying capacity resulting from the reclamation effort? Do the products from the site return to the system the necessary economic, social, and natural resource benefits needed?

4. What will be the long-term stability of the ecosystem after reclamation?

5. What are the differences between the reclaimed area and the original system in the availability of numbers of ecological niches and their carrying capacities and interaction with surrounding habitat?

6. What is the incremental, as well as total, impact on the hydrologic regime of the site and region?

7. Do the specific changes in land use resulting from the mining/reclamation activity bring about any secondary land use, economic or social changes?

10.1.1.3. D. Fumigation, p. 276

In this section the results of calculations attempting to assess the fumigation potential at Colstrip were discussed. Included were results of plume rise calculations corresponding to those days during the Nov. 1971 to Nov.1972 data collection period on which MSU detected a ground-based inversion and/or isothermal layer at Colstrip. The specific data and methods used in the calculations were described in Appendix A6 of Volume 3B, Power Plant Appendices.

As noted in Appendix A6, the data used to estimate the change of potential temperature with height $\left(\frac{\Delta\Theta}{\Delta Z}\right)$ through the ground-based stable layer included the temperature at the top of the layer and

the corresponding surface temperature. Heimbach (August 1974) suggested that the use of the surface temperature might result in overestimating the layer stability"....because of the intense pooling of cool air in the vicinity of the surface sensor.." (pg. 2). This overestimation could in turn cause the number of cases in which plume centerline remained in the stable layer to be overestimated. To calculate a $\frac{\Delta\Theta}{\Delta Z}$ value more representative of the layer of atmosphere through which the plume would actually rise, Heimbach advised using the tower top temperature (294 ft. AGL) instead of the surface temperature.

Following Heimbach's recommendation and the method outlined in Appendix A6, the effective plume rise was recalculated for the mornings on which a ground-based inversion and/or isothermal layer was detected. The results of these calculations are summarized in Table D. These results predict that the Colstrip plume centerline would remain in the stable layer in 58 cases, a reduction from the 74 cases predicted in the draft EIS.

As was discussed in Section 10.1.1.3D of Volume 3a, each case in which the plume centerline is predicted to be less than the stable layer top height represents a potential fumigation case. Thus Table D indicates a potential of 58 fumigation cases out of a total 165 days. Projecting the number of potential fumigation cases to an annual basis and also to the projected 37-year plant lifetime results in the following: annually, 128 cases; and 37-year plant lifetime, 4747 cases.

Table E results were obtained assuming the physical stack height of Units 3 and 4 to be 160 m (525 ft), the height proposed by the applicants. Because the effective plume rise is the sum of the physical stack height and the plume rise (see Appendix A11, p. 64, Volume 3b, Power Plant Appendices), an increase in the physical stack height would result in the same increase in the effective plume rise. Table E lists the difference between the top height of the stable layer and the predicted effective plume rise (using a 160-meter stack height). These differences can be examined to determine the impact of raising the physical stack height on the the number of potential fumigation cases. Based on the Table E

Table D

Plume Rise Calculations for Near Dawn Inversions and/or Isothermal Layers at Colstrip (90m to Top Height)

Date	Top Height (m)	u (m/sec)	T (^{0}k)	$\frac{\Delta\theta}{\Delta z}$ (^{0}C/m)	Effective Plume Rise (m)
10 Nov	433	1.8	278	.0430	356
11	219	2.2	268	.1615	281
12	524	2.7	270	.0461	331
15	418	4.9	275	.0119	377
20	189	10.3	283.5	.0068	N.S.
21	357	4.5	280	.0143	367
22	98	8.0	281	.0476	B.S.
23	67	4.9	273	N.S.	N.S.
24	296	1.8	275	.0204	413
25	280	4.5	276	.0203	346
26 Nov	113	4.5	272	.0745	B.S.
2 Dec	570	4.0	268	.0235	349
3	265	2.7	270	.0177	395
4	82	6.7	271	N.S.	N.S.
5	357	4.0	269	.0240	347
10	402	6.7	270.5	.0101	369
12	434	3.6	263	.0297	343
13	463	0.9	258	.0331	444
14	479	3.1	266	.0216	373
17	280	8.9	277	.0140	327
18	448	6.3	279	.0098	370
22	357	1.8	273	.0409	362
28	539	1.8	268	.0155	443
29	341	0.9	268	.0189	494
30	174	7.6	267	.0252	309
31 Dec	174	15.2	274	.0169	293

Table D cont. etc.

Date	Top Height (m)	u (m/sec)	T (^{0}k)	$\frac{\Delta\theta}{\Delta z}$ (^{0}C/m)	Effective Plume Rise (m)
1 Jan.	235	6.7	270	.0015	N.S.
6	113	13.4	276	.0011	N.S.
7	479	4.5	273	.0239	338
8	113	12.5	273	-.0204	N.S.
16	357	14.8	280	.0139	300
17 Jan.	357	5.8	283	.0281	310
16 Feb.	204	12.5	279	.0202	291
17	67	4.9	269	N.S.	N.S.
18	174	0.9	274	.0431	409
19	341	4.5	281	.0245	332
20	143	11.6	284	.0284	278
22	479	1.8	269	.0391	367
25	494	4.9	268	.0140	370
26	579	1.3	258	.0324	413
28 Feb.	219	8.5	282	.0206	307
5 Mar.	357	7.6	271	.0176	327
9	494	3.1	277	.0276	350
10	311	8.9	289	.0265	290
11	265	0.4	281	.0229	592
12	189	8.5	279	.0108	344
13	280	4.0	280.5	.0360	318
14	82	8.9	M	-	M
15	189	8.9	M	-	M
16 Mar.	250	9.8	M	-	M
9 Apr.	204	2.7	276	.0211	378
10	174	3.6	275	.0181	369
11	509	2.2	279	.0198	396
14 Apr.	250	4.0	277	.0173	364

Table D cont. etc.

Date	Top Height (m)	u (m/sec)	T (°k)	$\frac{\Delta\theta}{\Delta z}$ (°C/m)	Effective Plume Rise (m)
15 Apr.	235	10.3	279	.0167	309
16	372	5.4	277	.0158	350
20	494	6.7	273	.0177	332
21	158	4.9	279	.0403	B.S.
23	158	4.5	271	.0722	B.S.
24	539	6.3	274	.0160	341
25	174	7.2	281	.0121	346
26	210	6.9	277	.0079	N.S.
27	113	1.8	279.5	.1091	B.S.
28 Apr.	509	6.7	274.5	.0181	330
2 May	113	4.9	276	.0184	B.S.
3	189	4.9	278	.0198	341
4	524	4.9	279	.0213	336
11	265	5.4	276	.0257	322
13	448	7.2	283	.0056	N.S.
14	296	5.4	288	.0209	326
15	128	5.4	289	.1556	B.S.
16	341	6.7	294	.0197	314
17	509	4.9	292	.0246	320
18	707	7.6	286	.0127	337
22	326	7.2	284.5	.0127	341
23	235	6.3	283	.0270	308
24	448	1.3	282	.0162	458
25	570	4.0	282	.0121	386
26	296	4.5	279	.0151	364
29	204	2.2	282	.0246	377
30	479	5.8	284	.0149	345
31 May	189	2.7	292	.0299	343
1 June	326	4.9	291	.0208	330
5	357	3.6	291	.0098	402

Table D cont. etc.

Date	Top Height (m)	u (m/sec)	T (^{0}k)	$\frac{\Delta\theta}{\Delta z}$ (^{0}C/m)	Effective Plume Rise (m)
12 June	204	4.5	288	.0045	N.S.
13	143	5.6	284.5	-.0014	N.S.
15	204	6.0	288	.0168	333
16	646	4.0	287	.0148	367
20	326	2.2	282	.0106	448
22	158	3.1	288	.0083	N.S.
23	357	4.9	291	.0090	385
24	174	2.2	289	-.0092	N.S.
30 June	372	2.2	293.5	.0165	397
1 July	113	7.6	284	.0011	B.S.
3	235	4.0	282	.0070	N.S.
4	158	2.0	283.5	.0243	B.S.
5	448	2.7	288	.0134	403
11	539	2.2	290	.0122	426
12	143	3.6	290	-.0163	N.S.
13	357	2.7	296	.0165	379
17	158	6.7	286	-.0004	N.S.
18	341	4.0	288	.0169	357
22	204	4.5	286	.0168	352
28	280	6.3	293	.0244	307
29	646	6.7	297	.0112	343
30	265	2.7	299	.0092	422
31 July	158	4.5	290	.0112	B.S.
4 Aug.	296	1.3	287	.0185	440
5	341	1.8	293	.0268	376
7	387	5.8	293	.0209	319
8	402	0.4	291	.0104	653
9	296	4.5	292	.0277	318
15	783	1.8	291	.0114	450
16	478	3.6	293	.0191	352
18 Aug.	82	6.7	295	N.S.	N.S.

Table D cont. etc.

Date	Top Height (m)	u (m/sec)	T (^{0}k)	$\frac{\Delta\theta}{\Delta z}$ (^{0}C/m)	Effective Plume Rise (m)
22 Aug.	311	3.1	289	.0134	391
23	448	5.4	287	.0140	351
25	158	2.7	290	.0388	B.S.
28	463	5.4	294	.0183	329
29	326	4.0	297	.0191	342
30 Aug.	113	10.3	296	.0184	B.S.
4 Sept.	661	2.7	283	.0176	386
5	387	2.7	289	.0148	394
7	67	2.2	279	N.A.	N.S.
8	479	4.0	286	.0170	358
9	174	4.0	294	.0098	391
11	479	1.8	280	.0108	468
12	722	5.4	291	-.0068	N.S.
14	387	4.0	288	.0178	354
15	174	7.2	287	.0062	N.S.
16	250	5.4	290	.0235	319
18	738	2.2	287	.0178	398
19	357	3.6	300	-.0078	N.S.
20	113	5.8	282	-.0075	N.S.
21	570	3.1	279	.0135	399
23	174	3.6	285	.0026	N.S.
26	433	3.6	272	.0211	361
28	219	4.5	275	.0244	336
29	189	4.5	273	.0289	327
30 Sept.	113	5.4	288	-.0204	N.S.
1 Oct.	344	4.9	288	.0174	343
2	389	7.6	286	-.0028	N.S.
3	433	4.9	283	.0232	329
4	448	4.5	286	.0209	338
6 Oct.	631	3.1	275	.0214	368

Table D cont. etc.

Date	Top Height (m)	u (m/sec)	T (^{0}k)	$\frac{\Delta\theta}{\Delta z}$ (^{0}C/m)	Effective Plume Rise (m)
7 Oct.	357	4.9	287	.0150	353
12	631	2.2	275	.0279	373
13	219	0	287	.0198	(562)
15	509	3.1	276	.0136	401
16	341	3.8	282.5	.0054	N.S.
17	113	2.7	271.5	.0227	B.S.
18	829	1.3	M	-	M
19	433	4.0	279	.0194	355
21	326	2.2	281	.0098	456
25	280	5.8	281	.0155	344
26	387	2.2	282	.0158	412
28	570	2.7	273.5	.0160	401
31 Oct.	296	4.5	268	.0297	328
1 Nov.	265	3.1	279	.0143	395
2	265	3.6	279	.0126	393
3	204	4.5	281	.0072	N.S.
4	143	4.9	281	.0787	B.S.
6	204	6.7	278	.0010	602
7	479	2.7	277	.0244	367
8	174	2.2	280	.0324	360
9	219	4.0	277	.0105	401
10 Nov.	265	1.8	278	.0166	429

As a result of the calculated values of $\frac{\Delta\theta}{\Delta z}$, eighteen of the mornings listed in the table were classified as not stable and labeled N.S. The designation N.S. was applied if $\frac{\Delta\theta}{\Delta z} < .0085$ ^{0}C/m. This definition is similar to that given by Moses and Kraimer (1972) which was: stable if $\frac{\Delta\theta}{\Delta z} > .85$ ^{0}K/100m. Also, four of the table dates were designated M indicating missing 294 ft. temperatures. Eliminating the nonstable cases and missing data cases, low level stable layers existed at Colstrip on 138 of the 165 days on which mixing depth data was measured and 294 ft. temperature data were available. The designation B.S. indicates the stable layer top height was less than the proposed 160m stack height.

TABLE E

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
10 Nov.	433	356	77
11	219	281	-62
12	524	331	193
15	418	377	41
20	189	N.A.	-
21	357	367	-10
22	98	B.S.	-
23	67	N.A.	-
24	296	413	-117
25	280	346	-66
26 Nov.	113	B.S.	-
2 Dec.	570	349	221
3	265	395	-130
4	82	N.A.	-
5	357	347	10
10	402	369	33
12	434	343	91
13	463	444	19
14	479	373	106
17	280	327	-47
18	448	370	78
22	357	362	-5
28	539	443	96
29	341	494	-153
30	174	309	-135
31 Dec.	174	293	-119

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
1 Jan.	235	N.A.	-
6	113	N.A.	-
7	479	338	141
8	113	N.A.	-
16	357	300	57
17 Jan.	357	310	47
16 Feb.	204	291	-87
17	67	N.A.	-
18	174	409	-235
19	341	332	9
20	143	278	-135
22	479	367	112
25	494	370	124
26	579	413	166
28 Feb.	219	307	-88
5 Mar.	357	327	30
9	494	350	144
10	311	290	21
11	265	592	-327
12	189	344	-155
13	280	318	-38
14	82	M	-
15	189	M	-
16 Mar.	250	M	-

TABLE E (continued)

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
9 Apr.	204	378	-174
10	174	369	-195
11	509	396	113
14	250	364	-114
15	235	309	-74
16	372	350	22
20	494	332	162
21	158	B.S.	-
23	158	B.S.	-
24	539	341	198
25	174	346	-172
26	210	N.A.	-
27	113	B.S.	-
28 Apr.	509	330	179
2 May	113	B.S.	-
3	189	341	-152
4	524	336	188
11	265	322	-57
13	448	N.A.	89
14	296	326	-30
15	128	B.S.	-
16	341	314	27
17	509	320	189
18	707	337	370
22	326	341	-15
23	235	308	-73
24	448	458	-10
25	570	386	184
26	296	364	-68
29	204	377	-173
30	479	345	134
31 May	189	343	-154

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
1 June	326	330	-4
5	357	402	-45
12	204	N.A.	-
13	143	N.A.	-
15	204	333	-129
16	646	367	279
20	326	448	-122
22	158	B.S.	-
23	357	385	-28
24	174	N.A.	-
30 June	372	397	-25
1 July	113	B.S.	-
3	235	N.A.	-
4	158	B.S.	-
5	448	403	45
11	539	426	113
12	143	N.A.	-
13	357	379	-22
17	158	N.A.	-
18	341	357	-16
22	204	352	-148
28	280	307	-27
29	646	343	303
30	265	422	-157
31 July	158	B.S.	-
4 Aug.	296	440	-144
5	341	376	-35
7	387	319	68
8	402	653	-251
9	296	318	-22
15	783	450	333

TABLE E (continued)

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
16 Aug.	478	352	126
18	82	N.A.	-
22	311	391	-80
23	448	351	97
25	158	B.S.	-
28	463	329	134
29	326	342	-16
30 Aug.	113	B.S.	-
4 Sept.	661	386	275
5	387	394	-7
7	67	N.A.	-
8	479	358	121
9	174	391	-217
11	479	468	11
12	722	N.A.	-
14	387	354	33
15	174	N.A.	-
16	250	319	-69
18	738	398	340
19	357	N.A.	-
20	113	N.A.	-
21	570	399	171
23	174	N.A.	-
26	433	361	72
28	219	336	-117
29	189	327	-54
30 Sept.	113	N.A.	-

Date	Top Height (m)	Effective Plume Rise (m)	Difference T.H.-E.P.R. (m)
1 Oct.	344	343	1
2	389	N.A.	-
3	433	329	104
4	448	338	110
6	631	368	263
7	357	353	4
12	631	373	258
13	219	(562)	-343
15	509	401	108
16	341	N.A.	-
17	113	B.S.	-
18	829	M	-
19	433	355	78
21	326	456	-130
25	280	344	-64
26	387	412	-25
28	570	401	169
31 Oct.	296	328	-32
1 Nov.	265	395	-130
2	265	393	-128
3	204	N.A.	-
4	143	B.S.	-
6	204	602	-398
7	479	367	112
8	174	360	-186
9	219	401	-182
10 Nov.	265	429	-164

M: missing data
N.A.: not applicable as layer not stable
B.S.: stable layer top height less than proposed 160m stack height (beneath stack)

differences, Table F lists the number of potential fumigation cases corresponding to an increase in the physical stack height of 50, 100, and 150 m. For the purpose of comparison the previous values calculated for no change in the proposed stack height are also given.

TABLE F

ΔH	No. of Potential Fumigation Cases		
	165 Day Period	Annually	30 Year Plant Life
0	58	128	4747
50	43	95	3519
100	34	75	2783
150	19	42	1555

When considering the number of potential fumigation cases given in Table F, four potential sources of error in the calculations should be kept in mind. First, according to Heimbach (1975), the heights of the top of the inversion layer were measured only to within about ±76 meters (±250 ft.). Secondly, the absolute accuracy of the Briggs' plume rise equations as applied to Colstrip is not known. According to Moses and Kraimer (1972), Briggs' equations for plume rise in a stable atmosphere overpredicted the plume rise for large TVA power plants (Lakeview, Widow's Creek, Gallatin, and Paradise)./1

This does not prove that an overprediction would necessarily also occur at Colstrip, as site-specific conditions can affect plume rise, but it does illustrate that error is possible in Briggs' plume rise predictions./2 Thirdly, the calculated $\frac{\Delta\Theta}{\Delta Z}$ values may not accurately reflect the average $\frac{\Delta\Theta}{\Delta Z}$ value for the layer of atmosphere through which the plume would rise./3 The fourth potential error is the limited data base (165 days from one year) on which projections of potential fumigation cases are based. This error may not be very large because the 165 days included some days in all months from a continuous one-year period (see Table D) and because MSU concluded that the November 1971 to

November 1972 year of data at Colstrip appeared typical of the longer term mean climatic conditions in the Colstrip vicinity (Heimbach et al. 1973). Specifically with respect to morning mixing depths at Colstrip, MSU concluded "Thus, while early mornings may have been somewhat more stable than normal at Colstrip during the sampled year, they were not drastically so." (p. 55).

To summarize, Table D data indicate that a significant number of potential fumigation days would occur at Colstrip if the stacks are built as proposed. While a validated quantitative estimate could only be made based upon a calibration of the plume rise against actual plume rise measurements made at Colstrip, the number of potential fumigation days may be about 100 on an annual basis and may be on the order of 3,000 over the projected lifetime of the plant. Also, Table F data indicate that significant reductions in fumigation potential would occur if the proposed stack height were increased. An increase of 100 m in the stack height might reduce the potential cases by over one-half.

10.1.3.2. Ground Water, p. 358

In the second column, in the sixth line of the last partial paragraph, "1.26 x 10 gallons/day" should read "1.26×10^6 gallons/day".

10.1.4.6. Seismicity, p. 388

In the fifth line of the first column, "Ronge River" should read "Tongue River".

10.1.5. Soil, pp. 388, 389

Delete the lists headed "Soils of the Mountains #1," "Soils of the Foothills #1," and "Soils of the Plains #1-6" in the second column of page 388 and first column of page 389, substituting for them the following lists (note--"Soils of the Alluvial Lands (Flood-plains) #1" should remain as it is):

Soils of the Plains #1-6

1) Soils formed in material weathered from sandstones and shales on nearly level alluvial fans and terraces.

2) Soils developing in material weathered from shales on moderately steep to steep residual uplands.

3) Soils developing in loamy to clayey materials weathered from siltstones and shales on steep to very steep slopes in highly dissected badlands.

5) Soils formed in clayey and loamy materials weathered from interbedded parent rocks in dissected uplands, narrow low-gradient ridgetops and steep valley side-slopes.

6) Soils developing in clayey materials weathered from interbedded, steeply dipping sedimentary rocks.

Soils of the Mountains #1

1) Soils developing in material weathered from non-calcareous consolidated rocks other than granite on very steep or steep mountain slopes with significant outcrops of bedrock; upon limestone bedrock on very steep or steep mountain slopes; the mapping unit includes some rock outcrops.

Soils of the Foothills #1

1) Soils developing in loamy material which has been weathered from consolidated sedimentary and basic igneous rocks on moderately steep to steep uplands and steep lower valley sideslopes.

10.1.6.3. Forest Resource, p. 397

The following information is presented in answer to inquiries and comments concerning the timber and range resources on the Northern Cheyenne Indian Reservation.

The reservation contains 71,000 acres of commercial forest land. The tribe's income is generated 50% from timber and 50% from grazing. The forest land is far more productive in forest and range than adjacent areas partly because it receives 16 inches or more annual precipitation and partly because of good management practices. It should be noted that precipitation in the last 5 to 10 years has exceeded the average by 2 to 3 inches.

The annual allowable cut of timber for this area as written in the 1965 management plan is approximately 4 million board feet. This is currently under review, however, because of new inventory data that will be available at the end of June. The annual allowable cut will be published within a year and is expected to be substantially higher because of the following reasons:

1) There is now a greater acreage base, resulting from growth and accretion plus shift in utilization standards.

2) Some of the timber stands are overstocked and overmature and are therefore susceptible to insect attack.

The composition of basic forest types on the reservation is primarily ponderosa pine with some noncommercial Rocky Mountain juniper and hardwoods. BIA sources are reasonably confident that the future allowable cut will exceed 4 million bd. ft., but are unable to provide specific estimates until current inventory data are analyzed. Based on 50 years of data, the site index for ponderosa pine is estimated at 40 or 40 plus. Actual site data will also be available when current inventory data are analyzed.

Returns to the tribe from timber harvest are approximately $100,000 per year, but vary ($17,000 in 1969, $145,000 in 1973) with the timber market. Mill labor at the mills at Ashland and

Lame Deer that utilize timber from reservation and nonreservation land has provided tribal members with $600,000 income over the past five years.

Comprehensive range mapping on the reservation has not been done in the past. In general the range is predominantly in good to excellent condition with an average of 3 acres per A.U.M. Less than 10% of the range is in fair to poor condition and these small areas occur around water holes. There are presently 12,500 head of beef cattle grazed year around by the Northern Cheyenne Livestock Association (Coop group), 2,000 beef cattle on farm and pasture leases, and 2,000 horses on reservation range lands.

10.1.6.4. Range Resource, p. 406 (Range Condition Map)

The legend of the Range Condition Map was printed incorrectly. The correct matching of condition classes and map colors is given below:

Excellent	-	Yellow
Good	-	Brown
Fair	-	Light Green
Poor	-	Dark Green
Agricultural	-	Gray

10.1.6.6. Vegetation Chemical Analysis, p. 409

In the first column, in the last line of the paragraph labelled "3)," "(see Section 11.1.1.)" should read "(see Section 10.1.1.3.)."

10.1.6.6., p. 444 (Table 10-42)

In the second column (under the heading "Species"), the last two entries should be "Silver sagebrush" and "Big sagebrush".

10.1.7.1. Mammals, p. 460

In the first line of the first column, "53%" should read "91%". In the second and third lines, delete "38% were in

ponderosa pine openings,". In the first complete paragraph of the first column, third line, "47% should read "71%". In the last paragraph in the first column, first line, "67%" should read "61%". In the second and third lines, delete "or openings within the ponderosa pine forest".

10.1.7.1., p. 461 (Table 10-48)

Table 10-48 is reprinted, with corrections, on the following page.

10.1.7.1., p. 463 and 464 (Table 10-50)

Table 10-50 is reprinted, with corrections, following Table 10-48 in this volume.

10.1.7.2. Birds, p. 472

In the second paragraph in the second column, fifth and sixth lines, delete "and are again approaching the levels of the early 1960's".

10.1.7.2., p. 477 (Table 10-55)

In footnote 1, delete "(except 1973)".

10.1.9.1. Yellowstone River, p. 496 (Figure 10-40)

In the title, "(Elser 1973)" should read "(Elser 1974a)".

10.1.9.1., p. 500 (Table 10-60)

In the "Sinuousity" column, opposite River Section "Hathaway," "1.24" should read "1.21". In footnote 5, "Reservoir Creek" should read "Reservation Creek".

TABLE 10-48

Seasonal Antelope Use of Vegetation Types in the Colstrip Study Area

Major Type	Sept-Dec (116)[1]	Jan-Mar (677)[1]	Apr-May (266)[1]
Big Sagebrush-Grassland[3]	91[2]	71	61
Ponderosa Pine Forest	-	-	5
Ponderosa Pine Openings[4]	0	2	6
Agricultural	9	2	13
Grassland	-	25	15
	100	100	100

[1]Number of observations

[2]Percent of observations

[3]Including big sagebrush-grassland openings within ponderosa pine forest

[4]Includes only grassland openings

TABLE 10-50

Yearly Food Habits of Antelope in Southeastern Montana
Expressed as Percentage of Instances of use or
as Percentage of Rumen Content

	June (6)[2] (582)[3]	July (16)[2] (1990)[3]	Aug. (12)[2] (1567)[3]	Sept. (3)[4]	Oct. (9)[4]	Nov. (1)[4]	Jan. (9)[4]	Feb. (12)[4]	Mar. (7)[4]	Apr. (8)[2] (1144)[3]	May (9)[2] (1835)[3]
<u>Shrubs</u>											
Silver sagebrush				1	35	46	19	4	11	36	
Big sagebrush		6	8	Tr	1		76	79	78	15	12
Rubber rabbitbrush		6	12	3	1			3	5		
Broom snakeweed											1
Prairie rose		8	2	11	1						
Greasewood	Tr[5]			10							3
Western snowberry									3	2	
Snowberry					21						
Unidentified shrubs					14						
Others											1
Total Shrubs	Tr	20	22	25	73	46	95	86	97	53	16
<u>Forbs</u>											
Yarrow		Tr								2	19
Small-leaf pussytoes					3						Tr
<u>Arnica</u> <u>fulgens</u>											2
Fringed sage	17	1	17	8		6	Tr	11	3		
Longleaf sagebrush		3	28	1							
Aster				3			2				6
Threeleaved milkvetch	29	12		6							
Pale bastard toadflax				1							18
<u>Erigeron pumilus</u>	17										
Scarlet gaura		2									
Nuttall goldenweed				9							
<u>Lomatium</u> <u>foeniculaceum</u>										26	20
<u>Lomatium</u> <u>macrocarpum</u>										13	5

TABLE 10-50
(Continued)

	June (6)[2] (582)[3]	July (16)[2] (1990)[3]	Aug. (12)[2] (1567)[3]	Sept. (3)[4]	Oct. (9)[4]	Nov. (1)[4]	Jan. (9)[4]	Feb. (12)[4]	Mar. (7)[4]	Apr. (8)[2] (1144)[3]	May (9)[2] (1835)[3]
Forbs (Continued)											
Alfalfa		12	3	45							
White sweetclover		1	4								
Yellow sweetclover	33	35	18								1
Nuttall monolepis											2
Plains pricklypear		4			4						
Purple prairie-clover	4										Tr
Prostrate knotweed		5									
Silverleaf scurfpea											2
Salsify		1	8	1							
American vetch		1								Tr	2
Unidentified Forbs		1			9	48				2	Tr
Other Forbs (15)	1	1	1	1	4						1
Total Forbs	101	79	79	73	20	54	3	11	3	43	78
Unidentified grasses	Tr			Tr	7		Tr	2		2	1
TOTAL	101	99	100	98	100	100	100	99	100	98	95

[1]June through September from Wentland (1968); October and November from field data (1973); January through March from Bayless (1969); April and May from Campbell (1970).

[2]Number of separate feeding sites

[3]Instance of use (bites)

[4]Number of rumens sampled

[5]Tr = trace

10.1.9.1., p. 503

In the second complete paragraph in the second column, fourth from the last line, "estimated estimated fish biomass" should read "greatest estimated fish biomass."

10.1.9.1., p. 507

Delete the first complete paragraph in the second column, and replace with:

A total of 39 overnight gill net sets were made in the Yellowstone from Laurel downstream to the Bighorn River (Table 10-64). Six brown and two rainbow trout were captured in five nets in the river from the Highway 212 Bridge at Laurel to the confluence of the Clarks Fork of the Yellowstone River. The 16 net sets between the mouth of the Clarks Fork of the Yellowstone River and the east bridge in Billings captured ten brown trout and one rainbow trout. Between the east bridge and the Huntley Diversion Dam, six nets produced five brown trout. The section from the Huntley Diversion Dam to the mouth of the Bighorn River produced no trout, but 12 channel catfish and 16 sauger were taken in 12 nets (Marcuson 1974).

10.1.9.1., p. 520

In the last line of the first column, "17.2%, 3.9%, and 1.6% of" should be inserted following "17.9%," and before "the catch..."

10.1.9.1., p. 527

Delete the last sentence of the second complete paragraph in the first column, "Larger fish at Forsyth..."

10.2.1.1. Land Use Categorization, p. 551

In the second column, after the subheading "3. Industrial Sites" and before the paragraph that begins "The major heavy industry..." insert the following paragraph:

Industrial sites shown on the Land Use Site Patterns map include strip mines, power generating plants, oil wells and storage tanks, and non-urban factories.

10.2.2.1. Proposed/Potential Land Use, p. 558

Delete the second line in the first column, "while other lands are already being irrigated".

10.2.3.4. The Structure of the Rosebud Economy, p. 614

In the second and third lines of the paragraph under "3. Employment," "1967 through 1962" should read "1967 through 1972".

10.2.3.4., p. 621 (Table 10-91)

In the first column, the second entry, "1299", should read "1929".

11.1.1.2. Adequacy of Particulate Ambient Standards, p. 631

With respect to the draft EIS, Section 11.1.1.2., Adequacy of Particulate Ambient Air Standard, and Section 8.1.1.2. F of the Summary Volume which summarized 11.1.1.2. the applicants made the following comment:

> On page 120 (of the Summary Volume), the difficulties inherent in developing ambient air quality standards are addressed. Particular points are made with respect to the single vs. multiple pollutant standards, and, in the case of particulate matter, the question of particle size as a health issue is raised. These kinds of concerns were known at the time of development of the standards. It should be noted here that, as indicated in Table 10-7, Volume 3A, background particulate matter contains about 50% (at the McRae site) and 38.8% (at BN site) material of 1 micron and less in size. If the annual mean total suspended particulate levels at these sites increased from 10 to 12 $\mu g/m^3$ and even if all of the increase were of submicron particles, the difference would be essentially unmeasurable. While particle size is of scientific interest and may be of greater concern in heavily polluted urban areas, its significance here is far outweighed by the fact that the increase in particulate levels will be extremely low and frequently overshadowed by natural variations.

With respect to ambient air standards, the draft EIS attempted to point out that because of practical limitations such as the current state of scientific knowledge of pollutant effects, enforcement problems, and so on, existing ambient air standards do not necessarily guarantee the desired goal of protecting public health and welfare. As an example of how existing knowledge may limit the goal of protection, the draft quoted Corn

(1972), who stated that the ambient air standards were extablished on a single pollutant basis not because of the adverse effects of air pollution are adequately described on that basis, but because existing toxicological knowledge was insufficient to write multi-pollutant standards. As a further example of this point, in a paper entitled "A review of the Health Effects of Sulfur Oxides", Dr. David Rall, Director of the National Institute of Environmental Health Sciences concluded:

> The pollution in the air is a complex mixture of chemical substances of varying toxicity of which sulfur oxides are a principal component. Those compounds which pose the primary hazards to human health have not yet been identified nor have their relative contributions to human disease been fully determined. Efficient and effective control strategies are dependent upon the identification of these toxic elements. Ultimately, the goal of standard-setting should be the development of composite pollution indices rather than control of individual pollutants. (Rall 1973, pg. 3)

In the applicants' comment above, the argument is presented that from the perspective of the small projected increase of the annual total suspended particulate concentrations over existing background levels,/4 particle size is not significant with respect to Colstrip emissions.

A spokesman for the EPA recently stated:

> Because of the present scarcity of knowledge concerning the health effects of specific pollutants and combinations of pollutants, it will take years to develop the data base necessary to quantify the exact dose-response characteristics of fine particulates. Sufficient information does exist, however, to conclude that fine particulates must be controlled to fairly stringent levels if public health is to be properly protected. (Burchard 1974)

Because dose-response characteristics of fine particulates have not been established and because of the reasons summarized below, the Department is not convinced that the admittedly small increase in annual particulate concentrations is sufficient to dispel all potential concern with regard to Colstrip fine particle emissions. The additional reasons for concern include:

1) Estimates of the size distribution of the particulate emitted from Colstrip units indicate that average annual emissions in the size range 1.6μ and smaller may be on the order of 600 tons/yr for Units 3 or 4, and on the order of 1800 tons/yr for Units 1-4./5

2) Particles in the approximate 0.01 to 2.0 μ size range, the so-called "respirable fraction", have a high probability of reaching the alveolar regions of the lung (p. 634, Volume 3B, Power Plant, and Burchard 1974). According to Stern et al. (1973) the residence time of particles reaching this region "...is measured in weeks, months, or years." (p. 131)

3) Recent studies of the emissions of coal-fired power plants have indicated that toxic trace elements are preferentially concentrated on the respirable particles. (p. 635, Volume 3B)

4) The absorption efficiency for most trace elements in the alveolar regions is 50% to 80%. (p. 635, Volume 3B)

11.1.1.3. <u>Air Quality Model Analysis</u>, p. 635

A. <u>Air Quality Modeling</u>

The applicants have commented that the modeling of the results of the silver iodide plume tracer study conducted by MSU should

include the following considerations:

1) The fact that the tracer plume did not have the energy in it that would exist with a power plant plume.

2) The fact that the tracer plume was emitted from a point source while the Colstrip emissions will be from four large diameter stacks.

3) Recent work done on time averaging formulas (e.g. TVA, Hino).

4) Reasonable assumptions of σ_x and σ_y. If there is any meaning to σ_{y_1}, $\sigma_{y_2} \ldots \sigma_{y_4}$, σ_{x_4}, their use should be consistent by allowing only one-to-one relationships; eg. σ_{x_1}, and σ_{y_1}, and σ_{x_2} and σ_{y_2}. (p. 29)

The applicants went on to state, "in the draft EIS, the state did not take some of these things into account, and their results were in some cases unreasonable because of it." When appropriate and when the available data justified doing so, the above four considerations were included in the modeling in the darft statement. As two different model types, a dilution type and a Gaussian type, were used to estimate ground level pollutant concentrations, the relevancy of the above four points to each model will be discussed separately.

1. Dilution Model

The draft EIS dilution model was used to provide a preliminary indication of possible short term ambient air standard violations. The basis of this model was a dilution factor developed from the MSU tracer study data, including the ice nuclei emission rate and the maximum measured low level and ground level ice nuclei concentrations. Maximum ground level concentrations of the different

Colstrip effluents were estimated using the dilution factor and the proposed effluent emission rates. As was discussed in the draft, because the dilution model is incapable of predicting concentrations for the range of meteorological conditions which might occur at Colstrip, this model cannot be used to demonstrate that short term standards will not be exceeded.

The discussion in the draft EIS of the dilution model indicated several factors which would tend to make the model predictions exceed actual ground level concentrations resulting from the proposed Colstrip emissions. (Because of this probable over-prediction, the dilution model predicitons were described as "conservative" in the draft EIS.) The applicants' points 1 and 2 above were two of the factors specifically considered which would tend to result in over-prediction. As the applicants state, the proposed Colstrip stack plumes would possess significant amounts of energy which the ice nuclei plume in the tracer experiment did not. Because of this energy the stack plumes would be buoyant and would rise significant distances above the physical stack height, while the tracer plume did not. This fact is acknowledged on page 642 of the draft EIS with the statement, "Any plume rise would reduce ground level pollutant concentrations (below the levels predicted by the dilution model)." Page 644 of the draft EIS states, "The assumption that all emissions come from one source would result in (dilution model) estimates higher than can actually occur, as the emissions from four individual stacks would be diluted with environmental air more than one single emission assumed here." Point 2 above was not overlooked.

With respect to the time averaging formula used to convert the calculated 1-hour concentrations to 3-and 24-hour values, the Department was aware that using the value of 0.2 for the exponent p as suggested by Turner (1970) would result in higher calculated concentrations than would the value of 0.5 suggested by Hino (1968) or of 0.44 suggested by the Northern Great Plains Resource Program (1974). The use of 0.2 represented a "worst case" approach which was consistent with the other maximizing factors inherent in the dilution model and with the purpose for

which the dilution model was used--to provide a preliminary indication of possible short term standard violations. Because the model results indicated only one standard (the Montana 24-hour SO_2 standard) might be approached on only one occasion, specific consideration of the other exponent values (0.5 or 0.44) which would reduce the predicted concentrations was not considered to be of significant value./16

The applicants' point 4 above regarding "The reasonable assumptions of σ_x and σ_y" is not relevant to the dilution model.

2. Gaussian Models

In the Gaussian modeling the buoyant energy of the proposed Colstrip stack plumes was directly accounted for through Briggs' 1969 plume rise equations. These equations specifically utilize the following source parameters to calculate the rise of the plume above the physical stack height: the stack exit radius; the stack effluent exit velocity; the initial temperature excess of the stack effluent over the ambient air; and an empirical entrainment constant which accounts for the dilution of the plume with ambient air. The combined plume rise and physical stack height was input to the Gaussian models.

With respect to the calculation of the horizontal and vertical dispersion coefficients, σ_y and σ_z, from the tracer data, the presence or absence of energy in the tracer plume is not significant. The dispersion coefficients as used in the Gaussian model account for the turbulent structure of the atmosphere and how the turbulent structure would promote or suppress diffusion. In order to derive the Gaussian model, the assumption must be made that the quantity being diffused "... by definition, does not effect the dynamics of the air motions but is merely carried along by them" (Slade 1968, p. 81) Thus, the Gaussian model alone is incapable of accounting for any impacts on the existing turbulent structure due to source characteristics such as buoyant energy during the plume rise

or latent heat energy in a moist plume. Quantitatively estimating the error induced in the model predictions because of modifications of the ambient turbulent structure generated by the stack plumes in the absence of detailed field data is probably not possible. Qualitatively, given the other errors of unknown magnitude inherent in the Gaussian modeling as applied in the draft EIS (e.g., the error in measuring the dispersion coefficients, the error in the plume rise, the assumption of no pollutant reactivity, etc.), this particular error is probably not significant.

Point 2 above ("The fact that the tracer plume was emitted from a point source while the Colstrip emissions will be from four large diameter stacks") is also not a serious consideration for the Gaussian modeling. The purpose of the tracer study was to measure dispersion coefficients as a function of meteorological conditions and downwind stack distance. Existing meteorological conditions, and hence the dispersion coefficients, would not be changed significantly by the presence of four plumes emitted from four large diameter stacks rather than the one tracer plume.

Although not in any way related to the plume tracer study results, the Gaussian modeling did account for the Colstrip "large diameter stacks." As mentioned above, specific stack characteristics were considered in calculating plume rise.

Specific consideration was also given in the draft EIS short term Gaussian modeling to different time averaging formulas as suggested by the applicants in point 3 above. Because the one-half hour SO_2 concentrations predicted (using the preliminary MSU dispersion coefficient data) were high in some instances, the corresponding 1-, 3-, and 24-hour concentrations were calculated and reported using both the exponent 0.2 suggested by Turner (1970) and the exponent 0.44 suggested by the Northern Great Plains Resource Program (1974)/17 (see Tables 11-5 and 11-6 in Volume 3B, Power Plant, of the draft EIS). Values exceeding both Montana and federal SO_2 ambient air standards were calculated using both the 0.2 and the 0.44 exponents.

Although it was not discussed in the draft EIS, the Department

is aware that the technique used to calculate 24-hour concentrations (i.e., using the equation $\chi_2 = \chi_1 \left(\frac{T_1}{T_2}\right)^p$) does not follow the recommendations of Turner (1970) or the conclusions of Hino (1968). Turner suggests that the above equation "...probably would be applied most appropriately to sampling times less than 2 hours." (p. 38). Hino concludes that his recommended -½ power law (ie. $\chi_2 = \chi_1 \left(\frac{T_1}{T_2}\right)^{.5}$) "...is shown to be experimentally valid for the sampling durations...ranging from 10 minutes to 5 hours." (p. 158) The Northern Great Plains Resource Program (1974) applied the power law equation using p = 0.44 for 1-and 3-hour periods, but not for 24-hour periods. Since the draft statement was written, Heimbach (November 1974) analyzed the ground level data measured at Colstrip during the tracer study and concluded that the power law expression should not be used for Colstrip modeling for periods longer than 2 hours.

An alternative approach to using the power law equation for 24-hour periods is the climatological method described by Turner (1970) which was used in the draft EIS long term modeling. This climatological method was used by the Northern Great Plains Resource Program (1974) for 24-hour calculations, and was also recommended by MSU for Colstrip modeling (Heimbach 1974).

The applicants' fourth point above is a significant consideration for Gaussian modeling. The fourth point was: "Reasonable assumptions of σ_x and σ_y. If there is any meaning to σ_{y_1}, σ_{y_2}... σ_{y_4}, σ_{x_4}, their use should be consistent by allowing only one-to-one relationships; e.g. σ_{x_1}, and σ_{y_1}, and σ_{x_2} and σ_{y_2}." Allowing only one-to-one relationships between horizontal and vertical dispersion coefficients would definitely simplify the modeling procedure. Unfortunately, no evidence exists that simplification of dispersion modeling is a criterion for atmospheric behavior. Allowing only a one-to-one relationship is justifiable only if the actual atmospheric data supports

such a relationship. In other words, to make such a statement one must be able to show that the Colstrip dispersion coefficients represented by some horizontal curve σ_{y_1} were correlated only to those represented by a given vertical curve σ_{z_1}./8 As was discussed in the draft EIS (Section 11.1.1.3. C of Volume 3B, Power Plant), MSU did not satisfactorily stratify the dispersion coefficients versus meteorological conditions prior to the draft, and thus no correlations among horizontal and vertical coefficients were possible.

In the absence of any correlation, the most reasonable approach available to the Department was to attempt to make calculations using all possible combinations of the horizontal and vertical coefficients. To accomplish this, curves representing both the extreme and average (or "moderate", as referred to in the draft EIS) coefficient values were drawn on the plots of the dispersion coefficient data versus distance supplied by MSU. Calculations were then made and reported for all combinations of these curves. Page 674 of Volume 3B, Power Plant, discusses the results of these calculations:

> A comparison of the predicted SO_2 concentrations listed in Table 11-5 and 11-6 with the state and federal ambient air standards listed in Appendix A3 indicates that several of the Table 11-5 and 11-6 concentrations exceed standards. The highest predicted concentrations were associated with the extreme stability conditions (ie. extreme dispersion coefficient values), lines 1 and 4 in Figures 11-12 and 11-13. However, concentrations corresponding only to the more moderate conditions, lines 2 and 3, also exceed the Montana one-hour, the federal three-hour, and the Montana and federal 24-hour standards in both Tables 11-5 and 11-6.

However, because of the lack of a suitable stratification of the dispersion coefficient data, predictions of the frequency of occurrence of the concentrations which exceeded standards could not be made. For this reason the draft EIS stated on page 677,

of Volume 3B, Power Plant: "At this time, the state does not possess sufficient information to make a decision with respect to the compliance of Colstrip Units 1-4 with existing Montana and federal short term ambient air standards."

In summary in the draft EIS the Department could make modeling predictions only on the basis of the data available at that time. Also, the four points listed by the applicants were not overlooked in the draft modeling, but whenever appropriate and when data justified doing so, were taken into account. In light of these facts, the methods used, the concentrations predicted, and the conclusions reached on the basis of those concentrations were reasonable.

11.1.1.3., p. 639 (Table 11-1)

Entries in all three columns opposite "Ra (radium 226)" (the entries are "1.1," "2.6," and "3.7") should read "1.1 x 10^{-9}," "2.6 x 10^{-9}," and "3.7 x 10^{-9}."

11.1.1.3. Dilution Model Results, p. 647-648

Clarifications have been requested with respect to Tables 11-2 and 11-3 which list results of dilution model predictions. Tables 11-2 and 11-3 values were calculated from the proposed emissions for Colstrip Units 1-4 given in Table 11-1. Also, data in the column labeled "Max. Prob. Frequency Per 4 Days" in Table 11-12 are the maximum number of one hour occurrences within a continous 4-day period corresponding to the specified concentrations. With regard to this column, it should be noted that the Colstrip meteorological data on which the frequencies were determined did not include mixing depths. While a specific consideration of mixing depths is not necessary in dilution model calculations, mixing depth should be considered for frequency determinations, since a change in mixing depth holding other meteorological variables constant (e.g., wind speed, atmospheric stability, etc.) would change ground level pollutant concentrations.

11.1.1.3., p. 655

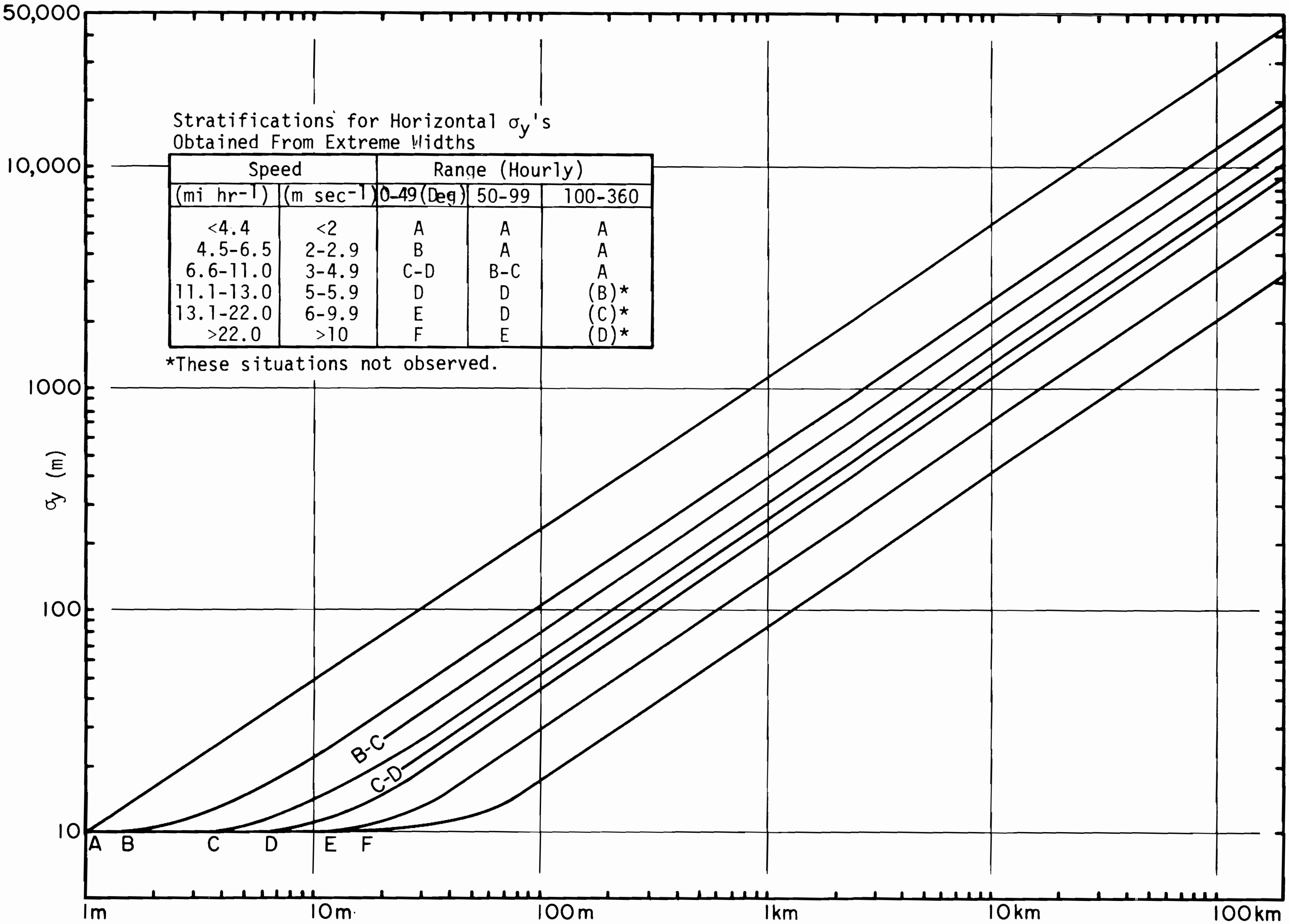
In the seventh line of the second column, "(0.2 ppm)" should read "(0.02 ppm)".

11.1.1.3. Gaussian Short-term Model Results, p. 667

The draft EIS concluded that:

> At this time the State does not possess enough information to conclude whether or not the Colstrip units will, in fact, violate the Montana one-hour or 24-hour SO_2 standards. The critical information that is lacking is the frequency of occurrence of the predicted concentrations. This frequency will be predictable when the dispersion coefficient data shown in Figures 11-12 and 11-13 is stratified versus the meteorological parameters measured at Colstrip. Work is continuing at MSU to complete this stratification and to verify the preliminary dispersion coefficient data shown in Figures 11-2, 11-3, 11-4 and 11-5. Results should become available to the state prior to the issuance of the final impact statement so that a decision with respect to compliance with the short term SO_2 standards can be incorporated.

MSU did verify the preliminary dispersion coefficient data and did stratify the coefficients versus Colstrip meteorological conditions prior to the completion of this final EIS. Figures B and C below are the results of the MSU verification and stratification./9 However, the MSU work was not completed in time for the Department to complete ambient modeling based upon these figures. Also, MSU has recently modified both the σ_y curves and the σ_y stratification shown in Figure B (Heimbach 1975). The Department not yet received these modifications. For these reasons, ambient air modeling results cannot be incorporated in the final EIS as originally planned.

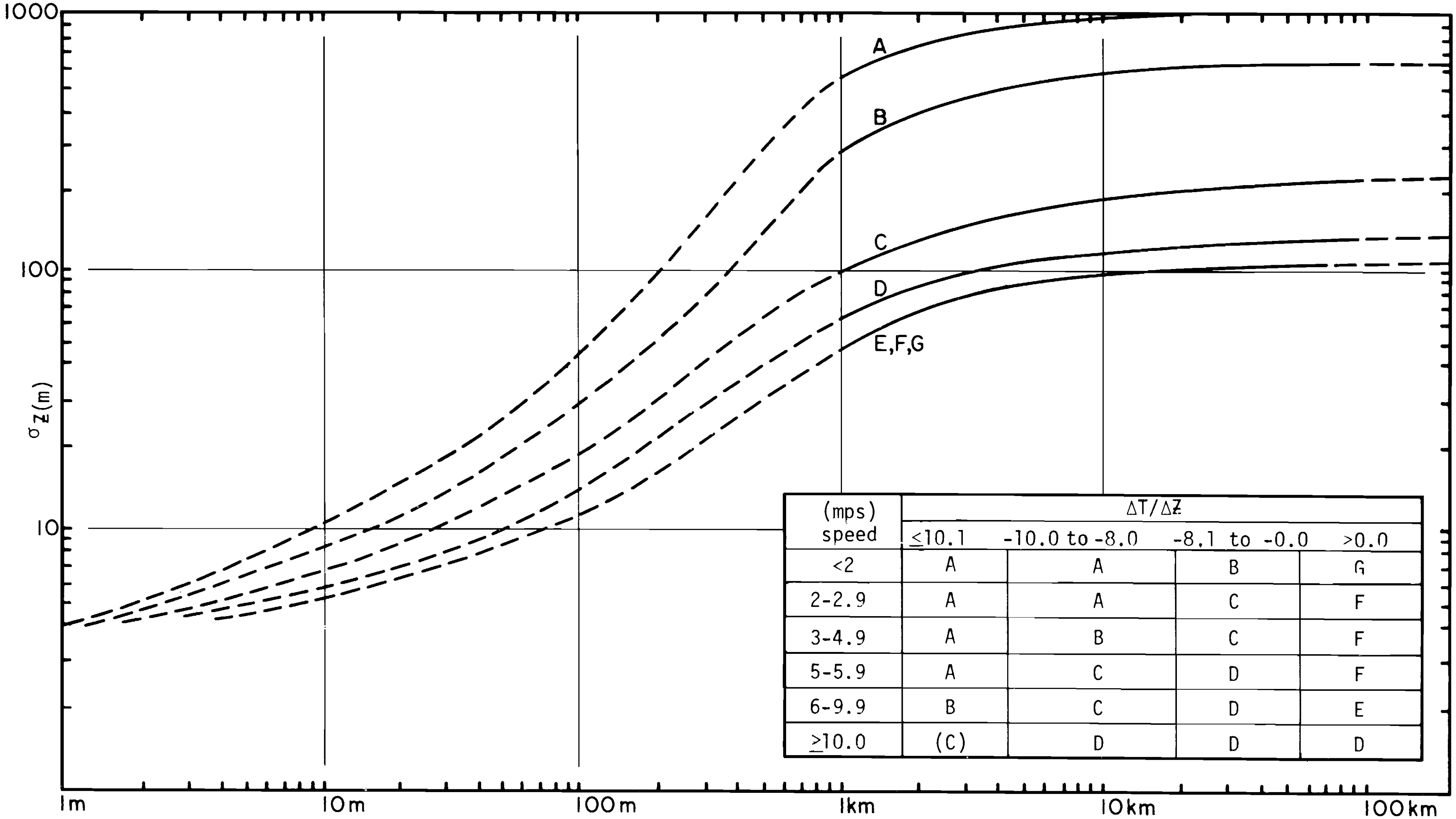


Stratifications for Horizontal σ_y's Obtained From Extreme Widths

Speed (mi hr^{-1})	Speed (m sec^{-1})	Range (Hourly) 0-49 (Deg)	50-99	100-360
<4.4	<2	A	A	A
4.5-6.5	2-2.9	B	A	A
6.6-11.0	3-4.9	C-D	B-C	A
11.1-13.0	5-5.9	D	D	(B)*
13.1-22.0	6-9.9	E	D	(C)*
>22.0	>10	F	E	(D)*

*These situations not observed.

FIGURE B



(mps) speed	$\Delta T/\Delta Z$ ≤10.1	-10.0 to -8.0	-8.1 to -0.0	>0.0
<2	A	A	B	G
2-2.9	A	A	C	F
3-4.9	A	B	C	F
5-5.9	A	C	D	F
6-9.9	B	C	D	E
≥10.0	(C)	D	D	D

DOWNWIND DISTANCE

FIGURE C

11.1.1.3. Air Quality At Existing Plants (addition)

Under the above heading, the applicants have made the following comments:

> There is further evidence that the air quality standards can be met. Contrary to the statement in the draft EIS that "no emission sources comparable to the proposed units...model prediction cannot be directly compared", there are many field data from large power plants that are of comparable size, (TVA, Pennsylvania, Ohio, Four Corners area) where terrain features are more complicated which indicate that the levels reported by DNR are very conservative. (MPC 1974, p. 30)

First, as is indicated, the applicants' quote of the draft EIS statement is only a partial quote, and the words deleted could significantly change the meaning of the quoted sentence for a reader without access to the original statement. The complete draft sentence is as follows: "Because no emission sources comparable to the proposed units currently exist in the immediate Colstrip area, model predictions cannot be directly compared with actual field data." Without the underlined portion of the sentence, the reader could form the impression that the draft EIS argued that, because no large power plants of the size proposed for Colstrip exist, draft model predictions cannot be directly compared to field data. This was not the argument intended by the draft statement. The intended argument concerning the comparison of model predictions with field data will be explained in reference to the next paragraph of the applicants' comments.

Secondly, projections of ambient effluent concentrations which were measured at one pollutant source and applied to another source at a different location, even though the sources themselves are identical, are of dubious value, for differing climatic or terrain conditions would cause different ambient concentrations to occur. It is for this reason that diffusion modeling using site representative data is necessary. The above statement by the

applicants implies that effluent concentrations resulting from a power plant located in a complicated terrain would be higher than at a similar plant located in a less complicated terrain. Without the specific consideration of climatic differences and a more detailed explanation of how the terrain is more complicated, this statement by the applicants cannot be considered valid.

The comments by the applicants continue:

Regarding the statement of "lack of existing pollutant sources...means that a verified quantitative assessment of the short term model accuracy cannot be made." The following table is included which gives measured SO_2 concentration for a comparable size coal fired plant with (sulfur content in the coal is about 3%) no scrubbers.

3-Hour Average Ground Level Concentration Distribution		24-Hour Average Ground Level Concentration Distribution	
Range ug/m^3	Number of Cases 1/1-68-9/19/69	Range ug/m^3	Number of Cases 1/1/68-9/19/69
28	51,097	28	3,064
29-280	10,574	29-56	4,248
281-560	443	57-112	400
561-840	102	113-168	92
841-1120	37	169-224	24
1121-1400	16	225-280	14
1401-1680	7	281-336	6
1681-1960	2	337-392	4
1961-2240	1	393-448	7
		449-504	1

In order to make a verified quantitative assessment of the accuracy of any model, a direct comparison must be made between model predictions for a certain set of input conditions and the

actual response of the system being modeled to those same input conditions. The data contained in the above table represent only the actual system response. No information regarding the existing system conditions which led to the response is given. The table data are therefore insufficient to make a verified quantitative assessment of any model.

Also, again the applicants chose not to quote the complete draft statement. The complete sentence is "The lack of existing pollutant sources in the Colstrip area similar to the proposed units (noted in the discussion of the long-term model accuracy) means that a verified quantitative assessment of the short term model accuracy cannot be made." (p. 677, Volume 3B, Power Plant) Again the words "in the Colstrip area" were deleted by the applicants. This is not a trivial deletion, because the lack of pollutant sources similar to the proposed units in the Colstrip area does in fact prevent the verified quantitative assessment of both the long and short term modeling as used in the draft EIS. The two major sources of error in the Gaussian modeling include: the unrealistic, simplifying assumptions necessary for the derivation of the model (i.e., the assumptions of homogeneous and stationary atmospheric conditions, of no pollutant reactivity, etc.); and errors made in specifying model input data which represent existing conditions at Colstrip (i.e., the dispersion coefficients, the effective plume rise, etc.). A comparison of model predictions with field concentrations measured at a site outside the Colstrip area could not reflect the second source of error - the error in the input data which describe Colstrip conditions. Also, the magnitude of the modeling error due to the first source, the inherent model assumptions, will be a function of Colstrip conditions. For example the reactivity of sulfur dioxide in the Colstrip plumes will be a function of local temperature and humidity and also of the other plume constituents (see p. 683, Section 11.1.1.7. of Volume 3B, Power Plant). Also, the degree of actual atmospheric inhomogeneity will directly reflect Colstrip area conditions. Thus, unless a similar sized and equipped power plant burning similar coal at a site with both a very similar climate and terrain to that at Colstrip exists, actual concentrations

measured at an alternative location would not necessarily quantitatively assess the error in the draft EIS modeling predictions.

The next paragraph of the applicants' comments under the heading "Air Quality at Existing Plants" states:

> These data (i.e. the data in the table quoted above) were collected by sensors located at points downwind where maximum levels are anticipated. If an adjustment for the sulfur content in the coal is made, all of the concentrations would be divided by about a factor of 4. Thus, the highest values such as 2240 $\mu g/m^3$ for 3-hours and 504 $\mu g/m^3$ for 24-hours would be reduced to 560 and 126 mg/m^3 (obviously $\mu g/m^3$ were the intended units), respectively. These levels are well below the Montana and EPA applicable standards.

Because the applicants did not establish the relevancy of the SO_2 concentrations in the above table to Colstrip, dividing them by 4 so that they "are well below the Montana and EPA standards" proves nothing with respect to Colstrip.

Continuing on page 31 of their comments, the applicants point out that the particulate emission rate listed for Units 1 and 2 in Table 11-1 on page 637 of the draft EIS is incorrect. The table value is 383.2 g/sec. The value should be 33.2g/sec (Westinghouse 1973 p. 2-101). This was a typing error and would not affect any modeling results.

11.1.1.3. Particulate Emission Rates (addition)

Since the draft EIS was written the applicants have supplied the Department with additional information with respect to particulate emission rates (MPC 1974 b and d), including estimated size and distribution data and sulfur dioxide emission rates. (MPC 1974 c and d)

Section 8.4.4.2. of Volume 3A, Power Plant, listed removal efficiencies for various particulate size classes obtained by the pilot plant scrubber system. These data applied to the operation of the pilot plant for an input dust loading to the pilot scrubbers of 2 gr/scfd (grains per standard cubic feet of dry air). However, according to the pilot plant study, "The average dust loading expected in the full-scale unit is 4 gr/scfd with a design maximum of 6.7 gr/scfd." (p. 28)

After inquiry by the Department concerning the possible effects of increased scrubber inlet dust loading on outlet particle size distributions, the applicants provided an estimated output particulate size distribution corresponding to an input dust loading to the scrubbers of 6 gr/scfd. This estimated distribution is labeled MPC 6 in Table G below. The justification for this outlet distribution supplied by the applicants was as follows:

> Our estimate of the effect of changes in the inlet dust loading is based on the industry consensus that scrubbers are relatively insensitive to such changes, and also on the fact that the reason for the low inlet grain loading is the high capture rate of ash as slag in the boiler available for testing. It is well known that boiler slagging increases as the size of the particles entering the boiler increases,...because the larger particles become more easily separated from the gas stream in the boiler and become attached to the walls. Therefore, a boiler that slags easily, such as the test unit will have an outlet particle size relative to a unit that does not slag easily. The Colstrip boiler design has been adjusted to reduce the slagging encountered in the test unit and will, therefore, have more coarse particles in the inlet dust than the test unit had. (MPC 1974b, p. 2)

To account for the increased dust loading in the coarse particles to the scrubbers in the actual units over the pilot unit, the applicants assumed "...the increased grain loading

Table G : Unit 3 or 4, Brink Stage

	1 >7μ		2 7-4μ		3 4-2.4μ		4 2.4-1.6μ	
	in	out	in	out	in	out	in	out
Table 2: gr/scfd g/sec Relative %	1.452	.0037 6.56 24.0	.414	.0002 .35 1.3	.112	.0004 .71 2.6	.044	.0007 1.24 4.5
MPC 6: g/sec Relative %		40.46 74.7		.24 0.4		.47 0.9		.82 1.5
EPD 6: gr/scfd g/sec Relative %	5.282	.0135 23.95 53.6	.414	.0002 .35 .8	.112	.0004 .71 1.6	.044	.0007 1.24 2.8
EPD 6.7: gr/scfd g/sec Relative %	5.982	.0152 26.96 56.5	.414	.0002 .35 .7	.112	.0004 .71 1.5	.044	.0007 1.24 2.6
EPD 4: gr/scfd g/sec Relative %	3.282	.0084 14.90 41.8	.414	.0002 .35 1.0	.112	.0004 .71 2.0	.044	.0007 1.24 3.5
Removal Efficiency	99.7%		99.9%		99.6%		98.4%	

Table G, Cont.

	5 1.6-.85μ		6 .85-.5μ		7 <.5μ		Total	
	in	out	in	out	in	out	in	out
Table 2: gr/scfd g/sec Relative %	.067	.0025 4.43 16.3	.038	.0022 3.90 14.3	.043	.0057 10.11 37.0	2.170	.0154 27.30 100.0
MPC 6: g/sec Relative %		2.93 5.4		2.58 4.8		6.68 12.3		54.18 100.0
EPD 6: gr/scfd g/sec Relative %	.067	.0025 4.43 9.9	.038	.0022 3.90 8.7	.043	.0057 10.11 22.6	6.0	.0252 44.69 100.0
EPD 6.7: gr/scfd g/sec Relative %	.067	.0025 4.43 9.3	.038	.0022 3.90 8.2	.043	.0057 10.11 21.2	6.7	.0269 47.7 100.0
EPD 4: gr/scfd g/sec Relative %	.067	.0025 4.43 12.4	.038	.0022 3.90 10.9	.043	.0057 10.11 28.4	4.0	.0201 35.64 100.0
Removal Efficiency	96.3%		94.2%		86.7%			

Table 2 refers to the average dust-loading values for P=17 in. H_2O given in Table 2 on p. 24 of the applicants' pilot plant study (Combustion Equipment Association Inc. et al. 1973).

MPC 6 is the distribution given in Attachment 4 to the letter to Department of Natural Resources from Montana Power Company dated August 27, 1974.

EPD 6 is the distribution calculated from the Table 2 distribution by increasing the Table 2 "in" value for stage 1(>7μ) by 6.0-2.17=3.83 gr/scfd.

EPD 6.7 is the distribution calculated as in EPD 6 corresponding to the maximum design scrubber inlet dust loading.

EPD 4 is the distribution calculated as in EPD 6 corresponding to the average expected scrubber inlet dust loading the volumetric flow rate 27,374 scfd/sec was used to calculate g/sec values from gr/scfd values.

(over the 2 gr/scfd pilot plant value) will appear primarily in the fraction greater than seven microns..." (MPC 1974b, p. 1)

After further correspondence concerning this matter the applicants supplied the Department with a more detailed explanation of the method of calculation of the MPC 6 outlet size distribution. Included with the explanation were the appropriate volumetic gas flow rates for Units 3 or 4 and for Units 1 or 2 (27,374 scfd/sec and 13,395 scfd/sec, respectively), calculated mass emission rates from the pilot plant outlet, 2 gr/scfd dust loading distribution, and also revised design maximum scrubber inlet dust loading values for Units 1 and 2.

Based upon these data and the following assumptions, which are derived from the previously quoted justifications given by the applicants for their MPC 6 outlet distribution, the Department estimated outlet particle size distributions for average and design maximum scrubber inlet dust loadings for Units 3 and 4 and Units 1 and 2. The results for Units 3 and 4 appear in Table G and those for Units 1 or 2 appear in Table H. The assumptions used in the calculations were:

1) All the increased inlet dust loading above the 2 gr/scfd pilot plant value occur in the particle sizes larger than 7 microns.

2) No change in the pilot plant removal efficiency of the various particle size fraction occurs due to the increased dust loading.

The magnitude of the error inherent in the above estimated outlet size distributions will remain unknown until an assessment can be made as to how realistically the assumptions 1 and 2 above describe the actual operation of the proposed scrubbers. Such an assessment would appear to be impossible prior to actual scrubber operation.

Table H : Unit 1 or 2, Brink Stage

	1 >7μ		2 7-4μ		3 4-2.4μ		4 2.4-1.6μ	
	in	out	in	out	in	out	in	out
Table 2: gr/scfd g/sec Relative %	1.452	.0037 3.21 24.0	.414	.0002 .17 1.3	.112	.0004 .35 2.6	.044	.0007 .61 4.5
EPD 3.78: gr/scfd g/sec Relative %	3.062	.0078 6.77 40.0	.414	.0002 .17 1.0	.112	.0004 .35 2.1	.044	.0007 .61 3.6
EPD 4.24: gr/scfd g/sec Relative %	3.522	.0090 7.81 43.5	.414	.0002 .17 .9	.112	.0004 .35 1.9	.044	.0007 .61 3.4
Removal Efficiency	99.7%		99.9%		99.6%		98.4%	

Table H , Cont.

	5 1.6-8.5μ		6 .85-.5μ		7 <.5μ		Total	
	in	out	in	out	in	out	in	out
Table 2: gr/scfd g/sec Relative %	.067	.0025 2.17 16.3	.038	.0022 1.91 14.3	.043	.0057 4.95 37.0	2.170	.0154 13.37 100.0
EPD 3.78: gr/scfd g/sec Relative %	.067	.0025 2.17 12.8	.038	.0022 1.91 11.3	.043	.0057 4.95 29.2	3.78	.0195 16.95 100.0
EPD 4.24: gr/scfd g/sec Relative %	.067	.0025 2.17 12.1	.038	.0022 1.91 10.6	.043	.0057 4.95 27.5	4.24	.0207 17.97 99.9
Removal Efficiency	96.3%		94.2%		86.7%			

EPD 3.78 is the distribution calculated from the Table 2 distribution by increasing the Table 2 "in" value for stage 1 (>7μ) by 3.78 - 2.17 = 1.61 gr/scfd. This distribution corresponds to the maximum design scrubber inlet dust loading.

EPD 4.24 is the distribution calculated as in EPD 3.78 corresponding to the average expected scrubber inlet dust loading.

11.1.1.5. <u>Fog Enhancement</u>, p. 681

In the next-to-last line of the first column, "57 to 83 kg/km/month" should read "57 to 83 $kg/km^2/month$".

11.1.1.6. <u>Visibility Impacts</u>, p. 681

The applicants' comments under this heading were as follows:

> The authors do not refer to natural dust that usually will reduce visibility significantly in parts of the country similar to Colstrip. Further, special attention is paid to the Los Angeles case, where DNR attempted to show the visibility problem is due to small size particulates (0.1 to 1). This is not an appropriate example because of the following:
>
> (1) Most of the haze in Los Angeles is due to photochemical process rather than particulates.
>
> (2) The pollution load in Los Angeles cannot be compared in any way with the levels that are expected in the Colstrip area.

The Department does not understand exactly what is meant by "...usually will reduce visibility significantly..." and would welcome any background visibility data for "...parts of the country similar to Colstrip" which the applicants may possess which could clarify this statement. Background visibility data calculated from integrating nephelometer readings made at two sites in the Colstrip area are given in Table 9 of Appendix A4 in Volume 3B, Power Plant Appendixes (p. 53). Both monthly average and short period minimum visibility data are given. The monthly average values do not indicate that a visibility problem currently exists at Colstrip.

The applicants' point 2 above reflects a misunderstanding of the draft EIS content. Nowhere did the draft attempt to compare the pollution load in Los Angeles with the levels that are expected in the Colstrip area. Reference to Los A eles occurs in the Friedlander quote contained in Section 11.1.1.2., Volume 3b. This section discusses the adequacy of existing particulate ambient air standards. The discussion of the potential impacts of the projected Colstrip particulate emissions on visibility is contained in Section 11.1.1.6. No reference to Los Angeles occurs in 11.1.1.6.

The Department would be interested in obtaining references for statement 1 ("Most of the haze in Los Angeles is due to photochemical process rather than particulates."). Gas to particle conversion is one part of the photochemical process (see for example Cadle 1972, p. 141). In discussing the genesis of photochemical smog Williamson (1973) stated:

> "As the smog matures, hydrocarbons and NO_2 are finally removed by side reactions which yield other secondary pollutants such as aerosols...About 95% of the particles have a radius less than 0.5 micron and so are effective in scattering light. They are a major cause of the reduction of visibility." (p. 302)

In discussing the results of the 1969 Pasedena smog study, Hidy et al. (1972) wrote, "The frequently observed visibility restrictions during periods of photochemical smog formation have been associated with changes occurring principally in the 0.1 to 1.0 μm diameter range of particles". (p. 219)

11.1.2.1. <u>Surface Water</u>, p. 689

Add after the second line in the first column, just above "B. <u>Water Quality</u>":

> On the basis of these predictions, it appears that no significant impacts to the Yellowstone River ecosystem would result from the 59-cfs water withdrawal for Units 3 and 4.

11.1.2.1. Acid Rain and Surface Water Quality, p. 690

There are several interactated issues concerning sulfur dioxide emissions and their impact on various components of the natural system. The soil system is of major importance, and is secondarily significant in governing potential impacts on the aquatic system. The collective surface areas of the streams near Colstrip are small enough that direct contact with falling rain-drops containing dilute sulfurous-sulfuric acid will not be the primary source of water acid. Much of the water in the streams comes from surface flow and ground water sources. The soil system, with its inherently high buffering capacity, tends to neutralize the acidity of the rainwater. The shallow soils occupying mid and upper slopes have free carbonates at or near the surface and readily neutralize any percolating waters and most of the surface runoff. It should also be noted that these slopes have the highest yield of surface water. None of the soils in the area of the proposed project are as intensely weathered as those in the eastern states, Norway, and Swéden where more exhaustive studies on acid rain have been conducted. In some of these studies, sizeable reductions in productivity have resulted from the impact of acid rain. The most important overall impact on the natural system due to sulfur oxide emissions is the direct injury to vegetation and subsequent impacts in accelerating soil erosion and degrading water quality.

11.1.2.1., p. 691

Delete the first two sentences of the last paragraph in the first column. Substitute this sentence:

> Using trace element emission rates given in Volume 3a, Chapter 8, Table 8-6, it can be estimated that 6.8 pounds per hour of fluorine (F), 0.97 pounds per hour of lead oxide (PbO), and 0.35 pounds per hour of mercury (Hg) would be emitted if all four units were operating.

On the same page, delete the existing Table 11-11, and substitute the following table:

TABLE 11-11

HYPOTHETICAL CONCENTRATIONS (in mg/1) OF FLUORINE, LEAD OXIDE, AND MERCURY FROM COLSTRIP STACK EMISSIONS (ALL STACKS) ASSUMING CONTINUOUS, INSTANTANEOUS AND COMPLETE DISSOLUTION OF ALL LISTED POLLUTANTS

STREAM	F (all forms)	PbO	Hg
Tongue River (423 cfs)	0.071	0.01	0.0037
Yellowstone River (13,030 cfs)	0.0023	0.0002	0.00012
Rosebud Creek (24 cfs)	1.25	0.177	0.065

11.1.2.2. Ground Water, p. 694

1. Ash Pond

The greatest potential threats to water quality are coal mining and the ash disposal ponds. Although certain mining impacts may be unavoidable (as long as mining proceeds), the ash disposal can be accomplished with insignificant impacts if properly designed.

Adequate evaluation of the ash pond design has been impossible because the applicants' plans are not certain. As late as December 5, 1974, personnel from the Department were unable to examine the ash pond site. The present owner of the site will not permit access by the applicants and whether the site will be

used is uncertain at this time. The first year's operation of Unit 1 will employ only the ponds which are being built adjacent to the plant site. The storage capacity of these ponds is a fraction of the life of the proposed plants.

Several problems exist at this time concerning the ash disposal plans:

1) The suitability of the proposed ash pond site (main pond) has not been determined. The site is surrounded by areas of clinker (Matson and Blumer 1973), which is generally a very porous and permeable material. The nature and porosity of the rock lying under the site is not known.

2) The main ash pond is not large enough to contain the ash expected to be produced over the life of the four power plant units. In about 20 years another site will have to be used. The location of this other site is not known, if indeed a second suitable site can be found.

3) Ultimate reclamation of the ash pond site has not been adequately explained. Ultimate use of the filled ash pond, containing 10 to 15 million tons of ash, could influence water quality for many years beyond the life of the plants.

4) Methods of monitoring the effects on groundwater to detect and rectify pollution problems are not known at this time.

11.1.2.2., p. 694

2. <u>Surge Pond</u>

The construction of the surge pond is nearing completion. The authorization for this facility was given under a previous permit and was not included in the present application. As pointed out in the impact statement (<u>Environmental Impact State-</u>

ment on the Proposed Montana Power Company and Puget Sound Power and Light Company Associated Facilities (Water Supply System) for Colstrip Units 1 & 2 Electrical Generating Plants at Colstrip, Montana, January 1974, Department of Natural Resources and Conservation) some water will seep into the earth from the pond, the amount determined partly by the permeability of the sandstone which directly underlies the McKay coal bed. Lateral movement of the groundwater is likely to occur in the Stocker Creek coal. Saline seep is not likely to be a problem. Most of the water which seeps into the aquifers will flow south and under the East Fork of Armells Creek or enter this stream east of the pond. Some surface seepage may occur in a small area where the Stocker Creek coal bed crops out on the hillside east of the dam. Judging from the good quality of water in the pond, any seepage, if not too great, is not expected to create salinity problems.

11.1.2.2., p. 694-5

MINING

Ground water is affected in three ways by strip mining:

1) partial destruction and draining of the original aquifer system resulting in altered ground water flow patterns.

2) chemical alteration of the ground water by oxidation, leaching, and the action of certain biological organisms upon great amounts of freshly exposed overburden and coal.

3) pollution of the mining area by the residue of explosives, spilled fuel and lubricants, refuse, and other materials.

Mining the large areas as planned will have certain impacts on the ground water systems near Colstrip. A number of existing wells will be physically destroyed (along with the natural landscape) by the mining. Other wells and springs, up gradient but

mostly down dradient, will undergo a diminished yield during the actual mining. Once the mining is completed and restoration of the landscape is accomplished, a new dynamic equilibirum will become established, and some or all of the wells and springs will return to their pre-mining yields. In a preliminary report, Van Voast (1974) indicates as many as 19 wells and three springs could be physically destroyed, four wells could become unusuable, and another five wells and two springs could become less useful due to lower yields.

11.1.4. <u>Impact on Soil</u>, p. 700-1

Delete those portions of Section 11.1.4. from its beginning on page 700 up to (but not including) the paragraph in the first column of page 701, which begins "in terms of the comparatively minor magnitude..." Substitute for the deleted sections the following:

11.1.4. <u>Impact on Soil</u>

The possible impacts on the proposed Colstrip Units 3 and 4 include the following:

1) Soil erosion and subsequent increase in sedimentation occurring primarily during construction of the proposed facilities;

2) Removal of the soils on the immediate project site from production through construction of the proposed plant;

3) Increases of heavy metals and other toxic substances in the soil system because of emissions from the proposed plant;

4) Soil erosion, resulting secondarily from plant emissions, directly causing a reduction in vitality, productivity or diversity in the vegetation which tends to hold the soil system in place;

5) Altered land use capability or productive potential as a result of coal mining activities; and

6) Uptake, translocation and/or accumulation of heavy metals or toxic substances in plants and particularly in animals occupying the higher trophic levels.

The most important of the above appear to be the increased potential for soil erosion, accumulations of heavy metals and/or toxic substances, and the direct impact of the coal mining on the soil resource. The sediment load in Armells Creek will be increased by the disturbance of the soil and vegetation during construction of the proposed plant. Any change brought about in the basic nature of the soil-plant system will have a corresponding influence on sediment yield. There are several existing man-caused sources of sediment in the watershed, including the town of Colstrip, highway and railroad rights-of-way, agricultural use of land, and the large areas occupied by spoil banks associated with current and historical coal extraction. The watershed has a naturally high sediment yield because of the steep slopes, impermeable and poorly developed soils, and relatively large amounts of barren ground found in the watershed. With careful design and implementation, the construction of the plant should not result in large increases of sediment in surface water.

The amount of sediment coming from the site could be reduced by several methods, including the following:

1) Seeding barren areas with plant species selected for their soil-binding characteristics as quickly

as the slopes are brought to grade;

2) Rapid back-filling and compaction of fill materials around pipelines and the plant to minimize the length of time the site remains disturbed;

3) Development of sediment dams or traps around large areas of disturbed materials;

4) Intensive efforts at seedbed preparation, including fertilization and mechanical treatment to loosen or compact the surface soil to maximize seed germination and growth; and

5) Storage and application of topsoil to provide a better medium for plant germination and growth.

A major impact upon the soils in the area would result from deposition of substances emitted during operation of the proposed plant. Three basic types of substances are of concern--heavy metals such as lead and cadmium, other toxic substances such as selenium and fluorides, and the sulfur-containing compounds. The distribution of heavy metals into this environment is particularly serious in that these elements are generally held in the surface horizons and potentially can be incorporated into plant tissue; in this state they could be transferred and concentrated in animals making up the remainder of the food chain. The importance of other substances varies. Fluorides have a toxic effect on vegetation and animals but differ from heavy metals in that they are often leached from the upper portions of the soil system. Selenium can be toxic to plants and animals, but its movement and transformation in the soil system is poorly understood. There is growing concern about deposition of sulfur-containing compounds, particularly in the form of acid rain. Long-term impacts could include lowering the soil pH or reaction which in turn would affect soil nitrogen accumulation and

transformation and the availability of plant nutrients, and potentially could synergize the impacts of heavy metals. The potential extent of these impacts, and the probability that they could develop at Colstrip, are unknown.

Some of the elements which will be discharged into the atmosphere will also be found in the ash ponds. Such elements include sulfur, fluorine, lead, mercury and silicon. Major changes in soil, surface and ground water chemical composition would occur if significant amounts of seepage from the ponds takes place. No prediction can be made of the total impact on the soil system because the rate and concentration of the seepage and the degree of oxidation of substances in the ash pond is unknown. If careful attention is given to the design, construction and maintenance of the facility, there will be minimal impact from seepage.

11.1.5.1. General Discussion (Vegetation), p. 704

In the last paragraph in the first column, fourth line, delete "economic" and substitute "biomass". In the fifth line, delete "agricultural and".

11.1.5.1., p. 706

In the second complete paragraph, second column, third line, delete "or pristine".

11.1.5.2. Acid Rain Effects on Vegetation, p. 716

In the seventh line of the second column, "adventitious building" should read "adventitious budding".

11.1.5.2., p. 719

In the first column, first complete paragraph, fourth line, insert "(dwarfed compared to normal-length needles)" after "short-long".

11.1.5.4., <u>Calculations and Predictions of Air Emission Impacts from Colstrip Units 1 through 4 on the Physical and Biological Systems of Colstrip and the Surrounding Fort Union Basin</u>, p. 737

It has been commented that the impacts of proposed plant emissions will be less because of the arid environment which dominates the Colstrip area. There are two basic elements which control the vegetational damage in dry areas. First, there is a sizeable amount of moisture at the point of damage on the leaf. Most xerophytic plants which inhabit the Colstrip area have morphological adaptations to the arid environment of the region. These include thick cuticle layers, sunken stomates, and/or the presence of a pubescent-rillous (hairy) condition which reduces air movement at the leaf surface. The largest amount of damage probably would not occur at the leaf surface. Sizeable quantities of gas and water vapor flow through the stomatal openings into the leaf. Phytotoxic emissions would also enter the leaf system through these stomates. The relative humidity in and around the spongy and pallisade mesophyll cells which are inside the leaf is 100% with rare exceptions. The conversion of sulfur dioxide to sulfurous acid can take place in this high humidity and is therefore not limited by the low relative humidities in which the plant is surviving.

Wide diurnal temperature flutuations produce frequent condensation of water vapor on the surface of vegetative material. In ponderosa pine this condensation is particularly important in that water vapor tends to collect in the sheath at the base of the needles. The damage can then be concentrated at that point.

The second factor of concern in evaluating the impacts of potential air pollutants in the Colstrip area involves the environmental regime in which the plants are living. There are many

environmental stresses with which the vegetation must cope. Some of these include problems of plant nutrition or soil fertility, available soil moisture, large potential transpirational losses, salinity-alkalinity, and wide diurnal and seasonal climatic variations. The presence of elevated concentrations of several air pollutants, albeit within existing standards, is an added stress for the plant. These stresses have not been a part of the evolutionary development of the plant species, and hence wide ranges in tolerance among species in the plant community can be expected and, in fact, do occur. The naturally occurring environmental stresses are severe and, when coupled with man-generated air quality problems, could result in compositional and/or biomass production shifts. The simplification of the biotic community which probably would result is very deleterious in relation to long term plant community stability.

11.1.5.4., p. 742 (Table 11-20)

The last note below the table, preceded by a double asterisk, should read "assume 33 ppm F^- in coal". Make the same correction in Table 11-22, page 745.

11.1.6.2., Impacts of Pollutants on Wildlife, p. 756

In the first paragraph under "B. Other Emissions" in the first column, replace the final period with "(Volume 3a, Chapter 8, Table 8-6)."

11.1.7.4. Radiation Impacts on Air Quality, p. 764 (Table 11-24)

The entry opposite Nuclide "Bismuth-214" in the column headed "MPC (air) $\mu Ci/m^3$" should read "3×10^{-2}" rather than "2×10^{-8}." In the same column, the entry opposite Nuclide "Polonium-210" should read "2×10^{-5}" rather than "7×10^{-6}."

On page 765, the entry opposite Nuclide "Thallium-208" in the column headed "MPC (air) $\mu Ci/m^3$" should read "3×10^{-2}" rather than "1×10^{-8}."

11.1.7.4., p. 766

Delete the first paragraph on page 766 and substitute the following paragraph:

> A comparison of the mpc of the uranium and thorium series nuclides in Tables 11-24 and 11-25 with Table 11-26 concentrations indicates that the highest Table 11-26 values are about 45% of the lowest mpc value (Polonium 218, 2×10^{-8} $\mu Ci/m^3$) for the uranium series and about 20% of the lowest mpc value (Polonium 212 and 216, 2×10^{-8} $\mu Ci/m^3$) for the thorium series. Utilization of the short-term diffusion model reveals the possibility that mpc for radionuclides in the uranium and thorium series may be exceeded for periods shorter than 24 hours. However, airborne concentrations of radionuclides should be averaged over a period of one year. The long-term diffusion model indicates that only a fraction of one percent of the mpc of radionuclides in the air will result from the operation of Colstrip Units 1 through 4.

11.2.2.1. <u>Impacts on Population Growth</u>, p. 771

In the second line of the paragraph labelled "2)" in the first column, "nataling" should read "natality".

11.2.2.1., p. 773

In the third-from-last line in the second column, "professional" should read "white collar". Make the same correction in the title of Figure 11-26, page 778.

11.2.2.1., p. 784 (Table 11-27)

In the third column (under "1975"), opposite "Direct," the number "745" should be inserted where a blank space now exists. The column will then read:

1975
9,357
6,501
745
2,111

In the title of Table 11-27, add a superscript "4" immediately following the word "CONSTRUCTION".

11.2.2.1., p. 786 (Table 11-29)

In the second line of footnote 2, "our migration" should read "out-migration". Make the same correction in footnote 3, second line. Add a superscript "4" immediately after the word "Alternatives" below the title. Add at the bottom of the page:

[4]Population estimates for 1980 and 1985 include base and direct population estimates. Construction-related population is not tabulated in these figures.

11.2.2.1., p. 787, 788

The last partial paragraph in the second column, which concludes on page 788, should be deleted, and replaced with the same paragraph correction given previously for Volume 1, 8.2.2.1., p. 158.

11.2.2.2. Impacts on Social Structure, p, 877

In the fourth and fifth lines from the bottom of the second column, "(N + 20)" should read "(N = 20)" and "(N + 208)" should read "(N = 208)".

11.2.2.3. Impact on Community Services, p. 937

6. Public Transportation, Highways, Roads, and Streets

The following comment has been recieved from the Department of Highways regarding Highway 315 (Colstrip - Forsyth) in Rosebud County: "...the Rosebud County Commissioners have designated Secondary 315 reconnaissance studies as their number three priority behind two construction projects on Secondary 447. The present annual funding for secondary roads in Rosebud County is approximately $60,000. Reconstruction of Highway 315 would cost approximately $250,000 per mile with 1974 monies. Priority 1 and 2 projects on Secondary 446 will obligate all of the county's secondary funds through 1980. While the Department of Highways recognizes the need, funding is presently not available to meet the population and traffic growth anticipated during the construction of Units 3 and 4."

11.2.2.4. Impacts on the Rosebud County Economy, p. 950

Projections of future government expenditures, per capita costs of government services, and tax rates often contravene research findings of other studies which have examined the effects of growth on local communities. In an effort to clarify the presentation in Section 11.2.2.4., additional data is here provided to further assess the impact of Units 3 and 4 on the Rosebud County economy.

1. The Costs of Population Growth

The development in Section 11.2.2.4. of three scenarios to assess the impact of the Colstrip project on the costs of government services and mileage rates necessary to provide those services made use of the assumption that the per capita cost of providing such services would remain the same. This assumption is tenuous when examined in the light of research conducted on other growth situations and when reviewing the trend of expenditures in Rosebud County historically. For example, a study of the vicinity of Langdon, North Dakota, where anti-ballistic missile sites were constructed, indicated sharply rising per capita costs of government services. During a three-year period (1970-1973), there was a peak population increase of approximately 8,000 persons spread over a six-county, predominantly rural area. The largest town, Langdon, had a 1970 population of 2,100 and a peak population of 4,500, which leveled off to 3,900 in 1973. The costs of needed public services for the area were funded by federal impact assistance. Twelve million dollars of federal funds supplemented by approximately one million dollars of local funds were required to provide needed facilities and programs, although it was not necessary to increase local mill levies. The per capita cost of increased population, including the short-term construction workers, was $1,500. The cost per additional worker was over $3,000, and the cost for each additional permanent resident was over $6,000 (Montana Department of Intergovernmental Relations 1974).

A study of the costs of urban growth prepared for the Pikes Peak Area Council also indicates increasing costs accompanying population growth.

> Most arguments favoring growth are economic ones, including the claim that growth helps a city pay its bills. Statements like "we must grow in order to broaden our tax base" or "we must grow in order to bring in more revenues" typify this point of view. If more people are added to the tax rolls,

> the theory goes, more funds will be available for needed public expenditures. There is, of course, a catch to this: the new taxpayers themselves need services--roads, utilities, sewers, schools, police, fire protection, etc.--and the city must spend additional money to provide them with these services. Still, the new revenues could conceivably exceed the new expenditures, thus making a net gain for the city, and this would be especially likely if there were an "economy of scale" in governmental operations analogous to that in manufacturing practice (making a million razor blades costs less money per blade than making just one). So the basic question is: Does growth lead to greater efficiency in local government and hence to net savings for the city and its people? The evidence we find is almost entirely negative; growth puts additional financial burdens on everyone. (Bradley 1974, p. 5)

> ...among the 148 Standard Metropolitan Statistical Areas (SMSA's) with populations larger than 200,000 people in 1970, those that *lost* population during the 60's averaged a 9% increase in per capita cost during the 5 year period 1962-67 whereas those that *gained* population averaged a 12% increase in per capita costs... (Bradley 1974, p. 6)

Another study, also conducted in Colorado, compared the change in per capita expenditures for all local jurisdictions (i.e., counties, municipalities, special districts, and schools) for the period 1960-1970 for counties whose population was growing, relatively stable, or declining. When comparing the counties by population size, small counties (e.g., 4,500-10,000 population) that experienced rapid population growth also illustrated the greatest increase in per capita expenditures for government-provided services. The average increase in per

capita expenditures was 90.2% from 1960 to 1970, as measured in constant dollars. This rate of increase was twice as high as that exhibited by more populated counties (e.g., population greater than 50,000) whose population was also rapidly expanding, and from 1 1/2 to 3 times higher than the rates of increase illustrated by counties whose population was stable or declining. (Lucas 1974, p. 68-76)

Each of the aforementioned studies points out that growth situations are accompanied by increasing costs. The last study is particularly useful in illustrating cost effects on sparsely populated counties faced with absorbing large increases of population. Arguments that increasing population growth contributes to "economies of scale" and, thus, lower per capita costs must be tempered with the knowledge that different settings offer varying potentialities for "economy of scale" operations. For example, in certain cases, it is less expensive to add subscribers to an existing sewer or water system in a well-populated area than in a sparsely populated locale where an equivalent population increase may demand a complete restructuring of the old system or the creation of a new one. As indicated in the discussion of social service delivery systems in Rosebud County (Sections 10.2.3.3. and 11.2.2.3.), the influx of population created by the Colstrip projects is taxing the existing capacity of the service delivery systems. New expenditures must be made to retain and/or improve the quality and quantity of services for new Rosebud County residents.

The Rosebud County Planning Board (1974) has issued a partial list of projects and estimated expenditures necessary to upgrade social services. The list includes:

	Approximate Expenditure
1. Sewage system and treatment plant for Forsyth	$1,000,000

2.	Reconstruction and resurfacing of Forsyth streets and alleys	$2,000,000
3.	Reconstruction and additions to the Forsyth city water system.	$735,000
4.	Municipal swimming pool	$200,000
5.	Shop facilities for city and county equipment	$160,000-$175,000
6.	Forsyth city equipment:	
	Street sweeper	$20,000
	16 yd garbage truck	$24,000
	Compacting machine	$25,000
	Second-hand patrol	$20,000
	Trucks	$37,000
	Law enforcement	$10,000
7.	Senior citizen center	$75,000
8.	County airport expansion	$405,000
9.	Improvement of Highway 315 to Colstrip	$7,500,000
10.	New jail facilities	$50,000
	TOTAL	$12,261,000-$12,276,000

Also included on the list was a solid-waste disposal system for Forsyth. The current system costs the city approximately $30,000 per year. The lease for the landfill expires in 18 months. Additional expenditures may be necessary when the lease is re-negotiated and/or if the volume of solid waste continues to expand. Current estimates place the cost of collecting and treating solid waste at $25.00 per ton.

The list provided by the Rosebud County Planning Board is conservative in its projections. No mention is made of potential expenditures that may be necessary if and when Colstrip incorporates as a municipality, necessary private expenditures for housing, commercial, or religious services, or school district expenditures. The last item is particularly significant for School District 19 at Colstrip. There, increased enrollments have required doubling the size of the instructional staff during the past year and have necessitated the use of modular classrooms in an effort to provide requisite classroom space. At some future time, additional permanent school facilities will have to be built at Colstrip. Furthermore, capital outlays have been the main focus of attention, yet population growth in Rosebud County will require expenditures not only for new facilities but also for additional service personnel. Rosebud County can expect increasing expenditures for new and improved service facilities as well as increases in the operating costs of the services.

a. County Government

Table I summarizes county expenditures from fiscal 1963-64 to 1973-74. Expenditures are for services provided at the county level (schools and special districts are not included). The figures have been adjusted for the effects of inflation (1967 = 100). A per capita calculation has been made using county population estimates developed by the U.S. Census Bureau, Montana Department of Health and Environmental Sciences, and Department of Natural Resources and Conservation. Table J presents the same information for eight other counties in southeastern Montana.

Examination of these tables indicates that per capita expenditures in Rosebud County and southeastern Montana have increased during the past decade. In Rosebud County the percentage change for the period 1964-74 was 46.7%. The corresponding figure for southeastern Montana was 22.3% However, extensive capital outlays in Custer County during fiscal 1963-64 bloats the per capita calculation for that year. Adjusting for

TABLE I

EXPENDITURES BY ROSEBUD COUNTY*

Fiscal Year	County[1/] Expenditures	Expenditures In 1967 Dollars	Estimated County Population	Per Capita Expenditures In 1967 Dollars
73-74	$1,530,676	$1,044,830	8,600	$121.49
72-73	1,974,999	1,483,846	8,300	178.78
71-72	900,133	718,382	6,400	112.25
70-71	869,132	716,514	6,100	117.46
69-70	617,223	530,716	6,032	87.98
68-69	594,730	541,648	6,100	88.79
67-68	576,475	553,239	6,300	87.82
66-67	531,595	531,595	6,500	81.78
65-66	475,156	488,844	6,500	75.21
64-65	535,272	566,425	7,100	79.78
63-64	477,042	513,500	6,200	82.82

1/ Figures for county expenditures do not include trust and agency expenditures or transfer payments. Such expenditures are primarily bookkeeping entries and do not truly reflect county payments for goods and services.

* Sources: Expenditures - County Clerk's Annual Report to State Examiner (for each fiscal year indicated)
Population - U.S. Bureau of the Census
Montana Department of Health and Environmental Sciences
Montana Department of Natural Resources and Conservation

TABLE J

EXPENDITURES BY EIGHT COUNTIES OF SOUTHEASTERN MONTANA*

(Treasure, Big Horn, Powder River, Carter, Fallon, Custer, Prairie, and Wibaux Counties)

Fiscal Year	Total of[1] All County Expenditures	Expenditures In 1967 Dollars	Estimated Total Population of Eight Counties	Per Capita[2] Expenditures In 1967 Dollars
73-74	$6,792,594	$4,636,582	35,000	$132.47
72-73	6,326,517	4,753,206	34,600	137.38
71-72	5,424,434	4,329,157	34,700	124.76
70-71	4,984,272	4,109,045	35,100	117.07
69-70	5,841,714	5,022,970	35,385	141.95
68-69	4,811,924	4,382,444	36,400	120.39
67-68	4,159,789	3,992,120	37,950	105.19
66-67	4,176,981	4,176,981	39,700	105.21
65-66	3,738,200	3,845,886	39,600	97.12
64-65	3,569,251	3,776,985	40,400	93.49
63-64	4,053,906	4,363,730	40,300	108.28

1/ Expenditure figures do not include trust and agency expenditures or transfer payments.

2/ Per capita expenditures are derived from dividing total expenditures by total population. As such, the per capita expenditures cited above do not represent any particular county.

* Sources: Expenditures - County Clerk's Annual Report to State Examiner (for each fiscal year indicated)
Population - U.S. Bureau of the Census
Montana Department of Health and Environmental Sciences
Montana Department of Natural Resources and Conservation

these outlays indicates a per capita increase of approximately 44%, very close to that experienced in Rosebud County. Comparing Rosebud County with southeastern Montana for the period 1972-74 (i.e. the years which have included construction of Units 1 and 2 at Colstrip) indicates a per capita increase of 8.2% in Rosebud County versus an increase of 7.7% for the eight other counties of the region.

A second trend indicated in the two tables is that per capita expenditures in Rosebud County held relatively steady for a period of time (1963-64 to 1969-70), followed by a large leap in per capita costs. While both tables illustrate fluctuations from year to year, the counties of southeastern Montana illustrate a more gradual upward trend than does Rosebud County.

However, large jumps in per capita costs are not peculiar to Rosebud County. Powder River County exhibited a similar but more dramatic increase in per capita costs during the late 1960's following the discovery of the Bell Creek oil field.

Also, given the small populations in the counties of southeastern Montana, any sizeable capital expenditure greatly increases per capita costs. This is clearly illustrated for fiscal year 1972-73 in Rosebud County. Per capita expenditures for that year are \$50 to \$60 higher than in the years preceding and following 1972-73. This increase is largely attributable to an \$860,000 (constant dollars) capital outlay to finance hospital construction. Given the existing deficiencies in Rosebud County's service capacity, large capital expenditures can be expected in the future and will contribute to raising per capita costs in a manner similar to that experienced in fiscal 1972-73.

At the county level the impact of the construction of Units 1 and 2 has not revealed itself in any abrupt leap in county costs--at least as measured by per capita costs. Total county expenditures have increased approximately \$600,000 from 1972 to 1974. Real costs (i.e. adjusted for inflation) have climbed approximately \$300,000, and population has expanded by nearly 2,200 persons.

However, cost figures are an imprecise measure of population-related impacts on social services. This imprecision results from a number of factors. First, budgets and tax collections by a public agency--be it a county, school district or any other agency--are set prior to actual disbursement of funds. If problems related to population changes should occur after budgets are set, it is hard to readjust for these difficulties unless extra funds are available. For this reason, there is usually some lag time between population changes and a reflection of these changes in the costs of public agencies.

Second, there is normally lag time before population changes are recognized as resulting in problems or potential problems. For example, rapidly increasing population may result in a growing work load for law enforcement agencies, but there is a lag between the recognition that the work load has increased and recognizing that additional peace officers are needed. School districts are usually more capable of foreseeing population-related problems and making the requisite financial adjustments because school enrollments can be constantly monitored (at least for 9 months).

Uncertainty or distrust of the future has its effect on expenditures by public bodies. This phenomenon characterizes Rosebud County. Local residents are reluctant to commit themselves to bonded indebtedness to finance capital expenditures in a situation where a large part of the recipient population is transient. Morever, even the expansion of services to meet the needs of the projected permanent populations is difficult when the future appears in flux(will coal development result in 2 or 4 generating plants, more mines, gasification plants?). Uncertainty over the future is reflected in a make-do attitude toward public expenditures. The roads may require maintenance beyond the capability of existing budgets, but those repairs will be neglected, at least temporarily. County government expenditures tend to reflect a make-do attitude more so than do school districts. Neglect of road repairs, weed control, etc., is considered less serious in both the long and short term than is the neglect of education for children. Thus far, while

county expenditures illustrate relatively little impact from population changes associated with the construction of Units 1 and 2, this pattern does not hold for school districts, particularly at Colstrip.

b. Schools

Table K summarizes school expenditures, school enrollments, and per student costs for Rosebud County, the eight other counties of southeastern Montana, and the state as a whole. Expenditures were derived from summaries of the school district trustee reports prepared by the Office of the Superintendent of Public Instruction. School enrollments were extrapolated from the Montana Education Directory.

The table indicates a number of trends. First, expenditures in current dollars illustrate a general upward climb for the state, the eight counties of southern Montana, and Rosebud County. Real expenditures (deflated to correct for inflation) are constant to declining in the eight other southeastern counties, while generally growing in Rosebud County and the state as a whole. School enrollments show a continual increase in Rosebud County, a continual decrease in the other counties of southeastern Montana, and in the state, an increase of 3 years followed by a decrease of 3 years.

Part of the enrollment increase in Rosebud County is attributable to coal development. This is illustrated, in part, by the enrollment jump of 173 students from 1972-73 to 1973-74. For the year 1974-75 (not shown on Table K) school enrollment in Rosebud County measured an additional 162 students, for a total of 1,763. Also, part of the Rosebud enrollment growth is attributable to the age structure of the county. A large proportion of Rosebud County population is between the ages of 0 and 17 years (school age).

Considering per-student expenditures, all three areas examined in Table K demonstrate considerable variation from

TABLE K

PUBLIC SCHOOL EXPENDITURES
IN ROSEBUD COUNTY*

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Public School Enrollment	Per Student Expenditures In 1967 Dollars
73-74	$1,965,929	$1,341,931	1,601	$838.18
72-73	1,656,577	1,244,610	1,428	871.58
71-72	1,372,205	1,095,136	1,398	783.36
70-71	1,468,899	1,210,964	1,345	893.65
69-70	1,376,346	1,183,445	1,334	887.14
68-69	1,230,614	1,120,778	1,291	868.15

PUBLIC SCHOOL EXPENDITURES IN EIGHT
SOUTHEASTERN MONTANA COUNTIES

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Public School Enrollment	Per Student Expenditures In 1967 Dollars
73-74	$9,266,600	$6,325,324	8,148	$776.30
72-73	8,411,710	6,319,842	8,235	767.44
71-72	8,256,680	6,589,529	8,627	763.82
70-71	9,277,728	7,648,580	8,837	865.52
69-70	8,079,194	6,946,856	9,035	768.88
68-69	7,209,780	6,566,284	9,175	715.67

* Sources: Expenditures - Summaries of Trustee Reports to the Office of the Superintendent of Public Instruction (prepared by that office for each year indicated).
Enrollments - Montana Education Directory (for each year indicated).

TABLE K (continued)

PUBLIC SCHOOL EXPENDITURES
FOR THE STATE OF MONTANA

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Public School Enrollment	Per Student Expenditures In 1967 Dollars
73-74	$207,572,453	$141,687,681	171,954	$823.99
72-73	184,246,792	138,427,342	172,350	803.18
71-72	167,394,524	133,594,991	173,417	770.37
70-71	161,062,393	132,780,209	174,532	760.78
69-70	163,116,367	140,254,830	173,774	807.11
68-69	145,050,252	132,104,055	172,548	765.61

year to year, although the eight counties of southeastern Montana and the state show a more clearly defined upward trend in per student costs than does Rosebud County. The general stability of per student costs in Rosebud County over time indicates that enrollment and expenditure increases in that county have been more evenly balanced than in the other regions examined in Table K. As indicated in Table K, Rosebud County has experienced higher per-student costs relative to the state and the other counties in southeastern Montana. The six-year average per-student cost in Rosebud County was approximately \$857.00; for southeastern Montana the figure was \$776.00; it was \$789.00 for the state. The Rosebud County per-student cost was 10.4% higher than the average cost in other southeastern Montana counties and 8.5% greater than in the state as a whole.

Table L summarizes elementary school district expenditures, enrollments, and per student costs for School Districts #4 (Forsyth), #12 (Rosebud), and #19 (Colstrip). Expenditure figures were drawn from the State Examiner's Audit reports of the school districts. Expenditures for fiscal 1973-74 and 1974-75 are estimates based on school district budgets. The specific items included in these estimates were the same as those reported in the audit sheets. Again, enrollments were drawn from the Montana Education Directory.

Table M summarizes general fund budgets, levied funds (i.e. permissive and voted levies), general fund millage rates, and the taxable valuation of the school districts. Information for this table was taken from the school district budgets as reported to the Office of the Superintendent of Public Instruction.

Table N illustrates a general pattern of increasing costs per student in each of the three school districts, although the increase is not even and often fluctuates sharply from year to year. District #12 at Rosebud has had, over time, the highest per-student expenditure, while district #4 at Forsyth has had the lowest per-student costs. With the advent of construction of Units 1 and 2, the Colstrip elementary district has illustrated

TABLE L

ROSEBUD COUNTY ELEMENTARY SCHOOL
DISTRICT EXPENDITURES*

District #4 - Forsyth

Fiscal Year	Total 1/ Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$415,314	$262,028	465	$563.5
73-74	355,911	242,943	447	543.5
72-73	320,686	240,936	403	597.9
71-72	280,618	223,957	381	587.8
70-71	263,240	217,016	373	581.8
69-70	249,131	214,214	398	538.2
68-69	179,274	163,273	336	485.9
67-68	164,924	158,276	310	510.6

District # 12 - Rosebud

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$149,668	$ 94,427	102	$ 925.8
73-74	133,229	90,941	85	1,069.9
72-73	117,910	88,587	72	1,230.4
71-72	105,861	84,486	95	889.3
70-71	102,462	84,470	89	949.1
69-70	95,897	82,457	96	858.9
68-69	89,121	81,167	105	773.0
67-68	80,721	77,467	107	724.0

1/ Expenditures for fiscal 1973-74 and 1974-75 are estimates derived from school district budgets.

* Sources: Expenditures - Budget and Application for tax levies for the years beginning July 3, 1973 and 1974 (school districts #4, #12, #19).
Enrollments - Montana Education Directory

TABLE L (continued)

District # 19 - Colstrip

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$542,737	$342,421	277	$1,236.2
73-74	227,833	155,517	178	873.7
72-73	139,250	104,621	141	742.0
71-72	86,470	69,010	126	547.7
70-71	76,743	63,267	89	710.9
69-70	83,933	72,169	75	962.3
68-69	61,644	56,142	72	779.8
67-68	61,884	59,390	72	824.7

TABLE M

ROSEBUD COUNTY ELEMENTARY SCHOOL
DISTRICT BUDGETS AND LEVIES 1/*

District #4 - Forsyth

Fiscal Year	General 2/ Fund Budget	Levied 3/ Funds	General Fund Millage Rates	Taxable Valuation
74-75	$367,449	$109,663	17.55 mills	$ 5,295,415
73-74	298,391	93,401	18.15 mills	4,614,223
72-73	283,692	86,527	20.34 mills	4,258,427

District #12 - Rosebud

Fiscal Year	General Fund Budget	Levied Funds	General Fund Millage Rates	Taxable Valuation
74-75	$ 90,977	$ 35,795	12.38 mills	$ 2,891,357
73-74	77,290	32,167	7.58 mills	2,299,028
72-73	85,195	35,279	13.83 mills	2,141,953

District #19 - Colstrip

Fiscal Year	General Fund Budget	Levied Funds	General Fund Millage Rates	Taxable Valuation
74-75	$533,142	$216,051	21.17 mills	$10,207,513
73-74	193,345	70,323	8.76 mills	8,031,340
72-73	115,531	53,873	7.72 mills	6,995,460

1/ All dollar figures are in current dollars.
2/ The figures for general fund budgets do not agree with the expenditures reported in Table L. Expenditure figures include items not covered by general fund budgets such as transportation, bus depreciation, retirement, debt service, etc. As such, general fund budget figures are lower than those reported for expenditures.
3/ Tax assessments at the district level only provide a portion of the total general fund budget for a school district. State funds through the Foundation Program contribute the remainder.
* Source: Budget and Application for Tax Levies (for each year indicated).

TABLE N

ROSEBUD COUNTY HIGH SCHOOL
DISTRICT EXPENDITURES*

District #4 - Forsyth

Fiscal Year	Total[1/] Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$272,594	$171,984	219	$785.32
73-74	251,583	171,729	210	817.76
72-73	212,615	159,741	182	877.70
71-72	199,244	159,014	178	893.34
70-71	183,395	151,191	183	826.18
69-70	175,489	150,893	172	877.28
68-69	169,968	154,798	174	889.64
67-68	168,370	161,583	172	939.44

District #12 - Rosebud

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$136,346	$ 86,023	53	$1,623.07
73-74	116,549	79,556	56	1,420.64
72-73	126,280	94,876	51	1,860.31
71-72	107,416	85,727	55	1,558.67
70-71	103,425	85,263	50	1,705.26
69-70	99,414	85,481	52	1,643.87
68-69	94,864	86,397	54	1,599.94
67-68	89,591	85,980	51	1,685.88

1/ Expenditures for fiscal 1973-74 and 1974-75 are estimates derived from school district budgets.

TABLE N (continued)

District #19 - Colstrip

Fiscal Year	Total Expenditures	Expenditures In 1967 Dollars	Total Enrollment	Per Student Expenditures In 1967 Dollars
74-75	$503,940	$317,943	186	$1,709.37
73-74	256,127	174,830	162	1,079.19
72-73	206,890	155,440	128	1,214.38
71-72	156,095	124,577	110	1,132.52
70-71	159,265	131,298	98	1,339.78
69-70	138,487	119,077	95	1,253.44
68-69	139,831	127,350	113	1,126.99
67-68	121,632	116,729	99	1,179.08

* Sources: Expenditures - Budget and Application for Tax Levies for the years beginning July 1, 1973 and 1974 (school districts #4, #12, #19).
Reports of Examination by the State Examiner (for each district - fiscal 67-68 to 72-73).
Enrollments - <u>Montana Education Directory</u>

TABLE O

ROSEBUD COUNTY HIGH SCHOOL DISTRICT
BUDGETS AND LEVIES 1/

District #4 - Forsyth

Fiscal Year	General 2/ Fund Budget	Levied 3/ Funds	General Fund Millage Rates	Taxable Valuation
74-75	$222,481	$ 74,636	8.84 mills	$ 8,453,852
73-74	190,476	65,111	9.14 mills	7,130,988
72-73	180,170	61,512	10.05 mills	6,140,200

District # 12 - Rosebud

Fiscal Year	General Fund Budget	Levied Funds	General Fund Millage Rates	Taxable Valuation
74-75	$105,902	$ 44,380	12.13 mills	$ 3,128,473
73-74	100,900	41,567	15.35 mills	2,710,712
72-73	99,531	40,333	16.09 mills	2,542,089

District # 19 - Colstrip

Fiscal Year	General Fund Budget	Levied Funds	General Fund Millage Rates	Taxable Valuation
74-75	$443,772	$175,279	14.74 mills	$11,894,844
73-74	206,069	67,290	5.21 mills	9,480,690
72-73	161,116	74,653	6.21 mills	8,317,216

1/ See footnote one of Table M
2/ See footnote two of Table M
3/ See footnote three of Table M
* Sources: Budget and Application for Tax Levies (for each year indicated).

sharply increasing per-student costs. It is estimated that per-student costs will have increased approximately $500 from the close of fiscal 1972-73 to 1974-75. Elementary districts in Forsyth and Rosebud do not mirror Colstrip and illustrate relatively stable to declining per-student costs.

The impact of population growth, increasing school enrollments, and school costs is also illustrated in Table M. School budgets and millage rates have climbed sharply at Colstrip vis a vis Forsyth and Rosebud. All three districts report increasing taxable valuations, but, at Colstrip, the more rapid rate of cost increase necessitated a large increase in mill levies. From 1973 to 1975 the Colstrip elementary district general fund budget increased 361.5%, levied funds grew 301.0%, millage rates increased 174.2%, and the taxable valuation of property increased 45.9%. Corresponding figures for Forsyth indicate a 29.5% increase in the general fund budget, a 26.7% increase in levied funds, a 15.9% decrease in millage rates, and a 24.4% increase in the taxable valuation of property. It is significant to note that the Western Energy Company mine, Big Sky Mine (Peabody Coal) and Units 1 and 2 are all located in the Colstrip school district. And, while these enterprises have contributed to an increase in the taxable valuation of the school district, the increase in taxable valuation has not been great enough to offset increasing costs except by increasing local school district taxes.

Information pertaining to expenditures by Rosebud County high school districts, enrollments, per-student costs, general fund budgets, millage rates, and taxable valuations are contained in Tables N and O. For the high school districts, Forsyth illustrates the lowest per-student cost and Rosebud the highest, with Colstrip in the middle. Per-student costs have been relatively stable (i.e., no significant upward or downward trend) in all three locations, although there are fluctuations from year to year. Enrollments have been very stable in Rosebud, while climbing in Colstrip and Forsyth. The major change in per-student costs is indicated for fiscal 1974-75 at Colstrip with a jump of approximately $700 over the previous year.

With regard to general fund budgets, levied funds, millage rates, and taxable valuations, the Colstrip high school district registers sizeable increases in all categories. The other two districts show moderate increases and, in some instances, decreases. General fund budgets increased 175.4% in the Colstrip district during the past two years. During the same period, levied funds increased 134.8%, millage rates climbed 137.0%, and the taxable valuation of property increased 43.0%. Both the Rosebud and Forsyth high school districts managed to reduce mill levies during the same period of time. Also, the taxable valuation of property increased by a greater degree than did budgeted funds for these two school systems.

In summary, it is evident that, unlike county expenditures, school costs at both the elementary and secondary level are beginning to reveal the impact of Units 1 and 2, particularly at Colstrip. Elsewhere in the county, school expenditures have been holding relatively stable or making some declines.

c. Municipalities

Table P summarizes expenditures, per capita costs of municipal services, city mill levies, and city taxable valuations for Forsyth, Hardin, and Baker. The last two cities have approximately the same population as Forsyth, are the county seats of their respective counties (Big Horn and Fallon), and lie within the same geographical area of the state (southeastern Montana). The purpose of including these two cities in the table is to offer a comparison between the costs of municipal services in small communities in southeastern Montana.

In examining Table P, Hardin shows the highest per capita cost, the most constant upward trend in per capita costs, the highest taxable valuation of property, and the greatest population. All these cities registered mill levy increases from 5 to 6 mills in fiscal 1973-74. The taxable valuation of property increased in all three cities during the past four years. Hardin added $273,642 to its

TABLE P

MUNICIPAL EXPENDITURES, MILL LEVIES, AND
TAXABLE VALUATIONS IN THREE CITIES OF
SOUTHEASTERN MONTANA*

Forsyth

Fiscal Year	Expenditures	Expenditures In 1967 Dollars	Estimated Population	Per Capita Costs In 1967 Dollars	Municipal Mill Levy	Municipal Taxable Valuations
73-74	$475,198	$324,367	2,800	$115.85	55.00 mills	$1,660,622
72-73	288,561	216,800	2,500	86.72	48.00 mills	1,593,052
71-72	229,872	183,457	2,100	87.36	48.00 mills	1,493,635
70-71	195,797	161,415	2,000	80.71	47.00 mills	1,407,935

Hardin

Fiscal Year	Expenditures	Expenditures In 1967 Dollars	Estimated Population	Per Capita Costs In 1967 Dollars	Municipal Mill Levy	Municipal Taxable Valuations
73-74	$618,529	$422,204	2,950	$143.12	57.25 mills	$2,618,028
72-73	456,070	342,652	2,900	118.15	51.12 mills	2,485,212
71-72	357,928	285,656	2,850	100.23	49.66 mills	2,463,635
70-71	354,956	292,627	2,800	104.51	51.39 mills	2,344,386

Baker

Fiscal Year	Expenditures	Expenditures In 1967 Dollars	Estimated Population	Per Capita Costs In 1967 Dollars	Municipal Mill Levy	Municipal Taxable Valuations
73-74	$351,600	$240,000	2,660	$90.23	62.00 mills	$1,896,729
72-73	259,256	194,783	2,640	73.78	67.00 mills	1,828,597
71-72	314,467	250,971	2,620	95.79	57.00 mills	1,833,875
70-71	260,784	214,991	2,600	82.64	57.00 mills	1,797,822

* Sources: Expenditures - City (town) Clerk's Annual Financial Statement to State Examiner
Population - U.S. Bureau of the Census - Montana, Department of Natural Resources and Conservati

tax rolls for the greatest increase in dollar volume, but Forsyth exhibited the greatest percentage increase (17.9%). Baker indicates greater fluctuations in per capita expenditures from year to year than do Forsyth and Hardin, although, over time, expenditures remain relatively constant (a four-year average equals $85.62). Hardin exhibits a relatively steady growth in per capita costs, increasing from approximately $104.00 in 1970-71 to $143.00 in 1973-74. In Forsyth, per capita costs were relatively constant during the first three years of the decade but then jumped approximately $30.00 per person in fiscal 1973-74, again illustrating the effect of large capital outlays by governmental bodies supported by small populations. During 1973-74 the city of Forsyth committed approximately $150,000 for work on its sewer system. Despite increasing population, per capita costs for city services increased.

The Rosebud County Planning Board has indicated that Forsyth must anticipate spending at least $4,000,000 to provide recreation, purchase city equipment, and upgrade streets, sewers, and the municipal water system. These estimates do not refer to additional operating expenses. Even if necessary capital improvements are pro-rated over time, the cost effect per capita will be significant. The cost of operating and maintaining Forsyth will increase for all of its residents.

2. <u>The Future</u>

The projections and discussions which follow are provided to describe the future in the most accurate terms possible given the information available. Future projections, whether they emanate from the Applicants' Environmental Impact Statement (Westinghouse 1973), advertising claims, the Census Bureau, Weather Service, or the Department are not to be confused with accomplished facts.

a. <u>The Future--Expenditures</u>

In the section of this discussion titled <u>The Costs of Population Growth</u>, a number of studies were cited which indicated that

population growth was accompanied by increasing per capita costs. The sections that dealt with county, school, and municipal expenditures indicated a historical pattern of the growth of per capita costs for government services within Rosebud County and elsewhere in the state. However, the tables did not indicate a smooth upward trend in per capita costs. Rather, there were fluctuations from year to year, certain periods of time when costs were relatively steady, and intervals when costs made sizable escalations.

When estimating future costs, it is possible to view the Rosebud County situation from a number of perspectives. Three are provided here. First, per capita costs could hold stable or decline, but neither possibility is considered a viable alternative in the long run. As indicated by the Rosebud County Planning Board and also within the draft EIS (Sections 10.2.3.3 and 11.2.3.3), population pressure is forcing the various governmental units into a position of upgrading the services they provide; doing so is expensive. Holding down costs appears to have its greatest potential at the county level. Provided the citizenry is willing to "make do" with declining road conditions, and put up with inconveniences that may emanate from overworked county agencies, county expenditures can be minimized. However, the Rosebud County budget for fiscal 1974-75 anticipates increasing expenditures. Excluding a reserve of approximately $436,000, the new budget is about $357,000 greater than that for fiscal 1973-74 (in current dollars).

School districts may also be able to hold expenditures down, particularly the districts away from Colstrip. The Forsyth district, able to occupy a parochial school building which had closed, is not faced with the problem of adding classroom space in the immediate future. Also, the school system at Forsyth is of sufficient size that it may be able to take advantage of "economies of scale" that are less available elsewhere in the county. For Colstrip, additional students will probably mean additional costs. This is reflected in the estimated expenditures for fiscal 1974-75. If Units 3 and 4 are added and school populations at Colstrip register another sizable jump, as they have in the past two years, the district is going to face the prospect of increased school capacity and costs.

The city of Forsyth appears to have little chance of holding down costs. An improvement in the city water system is scheduled for 1975, and sewer repairs are requisite. Each of these items is expensive and will significantly add to per capita expenditures. The acquisition of other capital improvements over time will create still higher expenditures per resident.

In the long run, it is doubtful that expenditures will make significant declines. The acquisition of capital improvements often requires bonded indebtedness paid off over the life of the bonds be it 5, 10, 15, 20 or more years. Thus, while costs can be held down for a certain period of time by "making do," they eventually increase when the problem is treated. Also, Rosebud County generally lacks the potential to achieve sizable "economies of scale," There have been varying estimates (with little agreement) as to what size county or city offers optimum low-cost conditions for its residents. However, the geographical size and population distribution of Rosebud County militate against economy of scale. The county government is responsible for a land mass of over 5,000 square miles. About 30% of the county population currently resides along the Yellowstone River (Forsyth vicinity), 30% in the vicinity of Colstrip, 30% along Highway 212 (Ashland, Lame Deer, and points south), and 10% scattered across the northern tier of the county near Ingomar, Sumatra, and Angela. The population distribution requires the county to open outposts in various locations to serve county residents (e.g., a welfare office in Lame Deer, Sheriff's deputies in Birney and Colstrip) rather than take full advantage of economies that attend centralization of services.

A similar phenomenon occurs in the schools. Rosebud County has three high school districts and parts or all of nine elementary districts. The geographical size of the county deters any significant changes in the school district size, number, and location, unless there is increased willingness to transport and board pupils. While Forsyth and potentially Colstrip may be of sufficient size to achieve some scale-related economies, it will not apply to all districts.

A second perspective toward viewing future costs is to see expenditures increase in a series of small steps from year to year.

This possibility appears viable for most of Rosebud County's governmental units. This approach allows a unit to meet some of its most pressing demands by adding manpower or small facilities, while postponing larger capital expenditures until a later date. However, at some point the larger expenditures must be made. This pattern of expenditure change will probably occur at all levels of government in the short run. Incremental increases at Colstrip will occur only if student enrollments hold steady or make small increases. Another influx of students will substantially raise costs.

There are at least three factors which will contribute to an incremental increase in expenditures: 1) A reluctance on the part of the citizens to commit themselves to large-scale capital outlays and willingness to make do with conditions as they exist; 2) Relatively stable patterns of population change (i.e., no big population increases) such that the need for additional expenditures does not become aggravated; and 3) Limits on the capacity for bonded indebtedness. By law a governmental unit or school district can float bonds equal to no more than 5% of its assessed valuation. For this reason, financing capital expenditures by bond issues constitutes a constraint on future spending. It is possible to get by this provision through tax levies and creating special improvement districts, but, given a general reluctance to raise taxes, such avenues to increased spending will not be open immediately. The limits on bonded indebtedness are particularly important for Forsyth. With an assessed valuation of approximately 7.1 million dollars, the city is limited to a bonded indebtedness of approximately $360,000. None of the requisite expenditures for sewers, water, or streets could be financed solely by the sale of bonds. Each expenditure will thus require additional revenues unless the city receives some form of outside assistance.

The third pattern of expenditure change consists of incremental cost increases during a transitional period followed by sizable jumps in costs when the county has achieved a measure of stability. This expenditure pattern denotes a reticence or inability to make expenditures in the present by deferring them to the future when they may not be needed or can be more easily financed. Rosebud County has

the need but not the ability to finance requisite expenditures by the usual methods at this time. (The county, city, and school district could finance a number of projects at this time, but, given the socio-economic climate of the county, it is unlikely that increased tax levies would receive much popular support.) In the future, when Units 1 and 2 become operational and mine tonnages increase to raise the taxable valuation of the county, financing increased expenditures will become more feasible.

Powder River County may serve as a model for Rosebud County's future. Table Q summarizes the effect of oil discoveries on Powder River's taxable valuation and the upward adjustment of county expenditures to make the money available. Prior to 1967 the taxable valuation of Powder River County hovered in a range between 4.2 and 4.5 million dollars; with the advent of large-scale oil production, the taxable valuation of the county registered a dramatic increase, climbing from 4.5 million dollars in fiscal 1967-68 to 35.6 million dollars in fiscal 1969-70. Tax assessments on mineral commodities are made on the value of production in the preceding year. Thus, oil production worth 43.6 million dollars in calendar year 1968 is registered on the tax rolls in fiscal 1969-70 as all or part of the 29-million-dollar assessment of net proceeds and royalties.

Expenditure patterns changed as quickly as taxable valuation. Prior to the oil discoveries, the county was spending about $85.00 per capita. After the oil discoveries raised the potential tax revenues of the county, per capita expenditures more than tripled to about $270.00 per person. In the intervening period graduated increases in expenditures were evident. At the same time, county mill levies declined, though mill rates again shifted upward in the 1970's as the taxable valuation of oil, and thus the county, diminished.

It is suggested that expenditures in Rosebud County will mirror, in part, the Powder River experience. Rosebud, unlike Powder River County, will not have an instantly created increase in taxable valuation. Construction of the generating units and increasing coal

TABLE Q

POWDER RIVER COUNTY OIL PRODUCTION, EXPENDITURES, TAXABLE VALUATIONS, AND MILL LEVY*

Calender Year	Oil Production (barrels)	Value of Oil Production (current dollars)	Fiscal Year	Taxable Value of Net Proceeds and Royalties (current dollars)	Taxable Valuation of County (current dollars)
1974	N.A.	N.A.	74-75	$26,611,856	$35,123,433
1973	8,181,598	$29,529,712	73-74	10,622,536	18,044,614
1972	6,335,666	20,023,822	72-73	9,655,580	16,710,360
1971	5,961,116	18,839,465	71-72	13,882,106	20,759,363
1970	7,843,259	23,137,574	70-71	25,540,992	32,242,210
1969	13,248,737	37,618,117	69-70	29,161,373	35,585,175
1968	16,572,472	43,586,601	68-69	1,685,215	7,667,052
1967	1,671,277	3,960,926	67-68	6,294	4,466,665
1966	N.A.	N.A.	66-67	12,312	4,340,494
1965	N.A.	N.A.	65-66	379	4,263,674
1964	N.A.	N.A.	64-65	N.A.	4,274,264
1963	N.A.	N.A.	63-64	N.A.	4,274,552

* Sources: Oil roduction and Value - Oil and Gas Conservation Division, DNRC
Taxable Value of Net Proceeds and Royalties - County Clerk's Report to the State Board of Equalization (for years indicated).
Taxable Valuation of County and Mill Levy - Property Tax Mill Levies (Montana Taxpayers Association (for each year indicated).

TABLE Q (continued)

Fiscal Year	County Mill Levy	County Expenditures	Expenditures in 1967 Dollars	Estimated Population	Per Capita Expenditures in 1967 Dollars
74-75	28.75 mills	N.A.	N.A.	N.A.	N.A.
73-74	38.75 mills	$850,319	$580,423	2,100	$276.39
72-73	35.35 mills	898,483	675,644	2,100	321.74
71-72	25.35 mills	864,903	690,266	2,500	276.11
70-71	24.60 mills	890,323	733,984	2,700	271.85
69-70	26.45 mills	787,711	677,310	2,862	236.66
68-69	31.00 mills	375,788	342,248	2,800	122.23
67-68	44.50 mills	245,763	235,857	2,600	90.71
66-67	37.25 mills	220,130	220,130	2,600	84.67
65-66	38.40 mills	204,252	210,136	2,600	80.82
64-65	35.05 mills	198,286	209,826	2,500	83.93
63-64	36.25 mills	207,491	223,348	2,500	89.94

Expenditures - County Clerk's Annual Report to State Examiner (for each year indicated).
Population - U.S. Bureau of the Census, Montana Department of Health and Environmental Sciences.

production will spread out the growth in taxable valuation over a longer period of time. There will be a lag time before large-scale expenditures can be made without hardship. However, although coal development for Rosebud County holds out the promise of large-scale increases in taxable valuation, it does not mean that all public service sectors will share in the coal-related gains. The county's taxable valuation will rise largely because the taxable valuation of School District #19 at Colstrip will rise. Forsyth and other school districts will not register any direct gains from the Colstrip projects. Whatever increase in taxable valuation they enjoy will be indirect, principally from homes and businesses built, expanded or opened as a result of coal development. The oil boom in Powder River County did little to raise the taxable valuation of Broadus as compared to the county government and county high school district. In fiscal 1967-68 Broadus had a taxable valuation of $494,654. By fiscal 1974-75 the taxable valuation of the town had grown to $676,633. In real dollars the increase in taxable valuation hasn't kept pace with inflation.

b. The Future--Taxation

The issue of taxation is one of the most volatile in Rosebud County. The applicants stress the quantity of taxes they will pay to the state, local governments, and school districts when the generating units are on-line. The local citizenry, particularly landowners opposed to the Colstrip project, point to increased tax assessments and charge that they are subsidizing coal development in the county. Their position is basically this: the activities of the coal and power companies have created 100% of the impact in the county. Rising costs to serve construction, mine personnel, and their families are being borne by local citizens (i.e., the indigenous population of the county prior to coal development) to a disproportionately greater degree vis a vis the coal and utility companies. The mining and power companies deny this charge. Both arguments have some degree of validity and will be examined forthwith.

Table R summarizes the taxable valuation of property classifications in Rosebud County from fiscal 1970-71 to 1974-75. The table indicates a general upward trend in the taxable valuation of property. One exception to this trend is found in the category of "other taxable property," which has declined approximately $140,000 in the past two years. Part of the slippage in this category is due to declining allocations from the state. Part is also due to declining assessments on coal. However, because an increase in the price of oil raised the taxable value of that property, net proceeds and royalties have been relatively stable during fiscal 1973-74 and 1974-75.

Tax assessments are made in March of each year. The value of property in the preceding calender year is calculated and entered onto the tax rolls for the next fiscal year. Thus, property evaluations which appear on the tax rolls for fiscal 1974-75 were assessed in March of 1974 on the basis of its value during calender year 1973.

Note that, in Table R, the value of livestock, personal property, and utilities all registered gains of over one million dollars in 1974-75. 1973 was a relatively good year for livestock producers. Prices were high and the taxable valuation of livestock commodities was raised significantly. Increases in the taxable valuation of livestock is principally paid by the 393 major livestock producers in Rosebud County. In 1973 the gross cash income of all farms in Rosebud County was $20,012,900. The increased taxable valuation of livestock is equal to approximately 5% of the livestock producers' gross cash income.

For utilities, the work completed on Units 1 and 2 during calender 1973 makes its appearance during fiscal 1974-75 as a taxable valuation of nearly 3.5 million dollars. This is approximately equal to 95% of all local utility assessments in the county. In 1973 Montana Power and Puget Sound Power and Light had a combined gross income of $227,417,991. The increased taxable valuation due to Units 1 and 2 is approximately equal to 1.5% of their gross annual income.

TABLE R

PROPERTY TAX VALUATIONS IN ROSEBUD COUNTY
BY CLASSIFICATIONS CATEGORY*

Fiscal Year	Real Estate and Improvements	Livestock	Personal Property	Operating Property of Public Utilities	Other[1] Taxable Property	County Total
74-75	$4,766,875	$3,572,820	$4,805,517	$3,671,729	$8,849,355	$25,666,296
73-74	4,252,651	2,564,288	3,427,277	428,493	8,940,284	19,612,993
72-73	4,114,383	2,047,148	2,828,483	136,240	8,995,502	18,121,756
71-72	4,653,055	1,919,234	2,534,238	114,974	5,088,171	13,709,672
70-71	3,995,390	1,698,952	2,489,678	109,766	4,221,644	12,515,430

1/ This classification includes allocations from the Montana Department of Revenue (fiscal 1974-75 = $2,205,543) and net proceeds and royalties from mineral production (coal, oil, metals, etc.)(fiscal 1974-75 = $6,643,812).

*Source: County Clerk's Report to the State Board of Equalization (for each year indicated).

Personal property taxable valuation increased about 1.4 million dollars in fiscal 1974-75. The largest item in this increase was mining machinery at $524,000. Mobile homes and manufacturing machinery added $195,000 and $200,000, respectively. Taxes levied against this equipment are paid primarily by construction workers and mining, power, and construction companies, not local, long-term residents.

The increased taxable valuation of property in the county has had an uneven effect. County expenditures have been held down, and the mill levy for county purposes declined by 10 mills in fiscal 1974-75. In Forsyth, the increased taxable valuation of city property (principally real estate and personal property) was not sufficient to significantly affect tax rates. As such, the anticipated city expenditures required a 55 mill levy, the same as in fiscal 1973-74. At Colstrip, despite large gains in taxable valuations from the generating units, livestock, personal property, etc., increased expenditures in the schools required increased mill levys. The additional taxable valuation was not sufficient to cover costs at existing (i.e. 1973-74) millage rates.

From one perspective, the landowners and residents of Rosebud County are correct in saying they are subsidizing coal development. This claim is more valid in the Colstrip school districts, where mill levies have increased, than elsewhere. Without the construction of Units 1 and 2, there would be little difficulty in accommodating the children of miners and local residents at reduced tax rates. However, without the coal mines and their contribution to the taxable valuation of the school district, past expenditure patterns could not have been maintained without increased taxation. Prior to the opening of the mines in the late 1910's, millage rates in the Colstrip school districts were comparatively higher than during the period of mine operations in the early 1970's (see Table S).

TABLE S

COLSTRIP SCHOOL DISTRICT MILL LEVIES FOR ALL PURPOSES*

	Fiscal Year	Mill Levy Elementary District #19	Mill Levy High School District #19
	74-75	41.13 mills	17.74 mills
	73-74	20.44 mills	8.53 mills
Start of Units 1 and 2	72-73	18.80 mills	8.88 mills
	71-72	18.60 mills	6.73 mills
	70-71	34.70 mills	17.62 mills
Opening of Mines	69-70	32.61 mills	16.01 mills
	68-69	41.25 mills	19.82 mills
	67-68	39.72 mills	13.46 mills
	66-67	37.50 mills	12.70 mills

* Source: Property Tax Mill Levies (Montana Taxpayers Association (for each year indicated).

Table S indicates, in part, the influence of mining and construction activities on Colstrip school district levies. It also points to the relative cost of mining activities _vis a vis_ construction. The mines make large contributions to the taxable valuation of a district or governmental unit without making large demands for additional services. Population increases due to mining are relatively small and can be absorbed with little cost effect. Construction adds a large volume of people quickly but raises taxable valuations slowly, creating a lag time before taxable valuations are adjusted upward to make it more feasible to provide services required by the construction-related population.

There is one additional factor that enters the picture which fails to make itself known in lists of tax levies and expenditures --declining quality of services. Mill rates may change, taxable valuations increase, and yet the quality of services may deteriorate. This is occurring in Rosebud County where millage rates have dropped, in Forsyth where rates are the same as last year, and in the Colstrip school districts where mill rates have climbed. Teacher turnover, overcrowded classrooms, deteriorating streets and roads, and inadequate sewer and water systems are costs borne by long-term residents and transients alike. It is possible to put a dollar figure on the cost of repairing or replenishing these services, but it is impossible to tabulate the human cost of inconvenience or damage done because the quality of services declined.

In a qualitative sense, local, long-term residents are subsidizing coal development. That cost, however, is not borne by local residents alone but also by the mine and construction-related population. From a strictly economic perspective, the question of who is subsidizing whom is open to question. To be sure, Colstrip area residents are paying increased costs for the schools, as are the citizens of Forsyth for municipal services. But, coal development has added to the tax base of the county and other governmental units funds which, if absent, would contribute to higher levels of taxation or fewer services.

The applicants' claim that the Colstrip project will mean increased tax revenues to local and state agencies is not without foundation. The capital outlay for the generating units is enormous and has the potential to double, treble, or even quadruple the existing taxable valuation of the county. A small part of this potential taxable valuation is registered in fiscal 1974-75; Units 1 and 2 contribute approximately 3.5 million dollars. Coal royalties and net proceeds have been entered in the county taxable valuation since 1970.

Table T contains the estimated taxable valuation of Rosebud County from fiscal 1975-76 to fiscal 1981-82. The table assumes the construction of Units 1 and 2 along with increased coal production for the plants. Also located in Table T is an estimation of future county expenditures (constant dollars). The model for expenditures change is patterned after that experienced in Powder River County. This is, expenditures increase in small steps during the construction or transitional period, followed by a sizable increase when taxable valuations reach their approximate peak. At this point, it is assumed that requisite capital expenditures, perhaps delayed, can be more easily financed. Also, the capacity for bonded indebtedness is increased.

The mill levies shown in Table T are for county-wide services. Added to this figure are 46 mills from state-wide property tax assessments (i.e., 6 mills for the university system and 40 mills for equalization payments through the state foundation program). Also, special district levies, municipal millage rates, and school district levies must be added to the totals presented in Table T. These levies are not applied on a county-wide basis and are excluded from the table. If the current levy of 55 mills is maintained in Forsyth, the total mill levy for Forsyth residents would be increased 55 mills beyond that projected in the table.

Table U summarizes the same type of information contained in Table T, but includes the additional influence of Units 3 and 4 and associated expansions in coal values. The same expenditure pattern used in Table T is duplicated in this presentation.

TABLE T

ROSEBUD COUNTY TAXABLE VALUATION, EXPENDITURES
AND MILL LEVIES, WITH UNITS 1-2
(1973 Dollars)*

Fiscal Year	Estimated County Taxable Valuation	Estimated Per Capita County Expenditures	Estimated Population	Estimated Total County Expenditures	Estimated County Mill Levy	Total[1/] County Mill Levy
81-82	$59,842,000	$342.00	8,140	$2,783,880	46.52 mills	92.52 mills
80-81	59,998,000	342.00	8,000	2,736,000	45.60 mills	91.60 mills
79-80	60,020,000	342.00	7,862	2,688,804	44.80 mills	90.80 mills
78-79	60,495,000	342.00	7,950	2,718,900	44.96 mills	90.96 mills
77-78	56,835,000	274.00	8,137	2,229,538	39.23 mills	85.23 mills
76-77	46,803,000	214.00	8,600	1,840,400	39.32 mills	85.32 mills
75-76	36,775,000	194.00	9,500	1,843,000	50.12 mills	96.12 mills

1/ Included in this total is the 46 mill rate for the university systems and school foundation program

* Sources: Taxable Valuation, Montana Department of Natural Resources and Conservation Draft EIS on Colstrip Units 3 and 4.

TABLE U

ROSEBUD COUNTY TAXABLE VALUATION, EXPENDITURES, AND MILL LEVIES WITH UNITS 1-4 (1973 Dollars)*

Fiscal Year	Estimated County Taxable Valuation	Estimated Per Capita County Expenditures	Estimated Population	Estimated Total County Expenditures	Estimated County Mill Levy	Total[1/] County Mill Levy
81-82	$103,910,000	$342.00	9,420	$3,221,640	31.00 mills	77.00 mills
80-81	101,911,000	342.00	9,400	3,214,800	31.55 mills	77.55 mills
79-80	96,829,000	342.00	9,374	3,205,908	33.11 mills	79.11 mills
78-79	85,875,000	342.00	10,500	3,591,000	41.82 mills	87.82 mills
77-78	70,035,000	274.00	11,849	3,246,626	46.36 mills	92.36 mills
76-77	51,003,000	214.00	11,000	2,354,000	46.15 mills	92.15 mills
75-76	36,775,000	194.00	9,500	1,843,000	50.12 mills	96.12 mills

1/ See footnote one of Table

* Sources: Taxable Valuation, Montana Department of Natural Resources and Conservation Draft EIS on Colstrip Units 3 and 4.

Both tables assume that all county-wide expenditures are financed solely by tax levies. In reality this is not the case. Counties receive many forms of revenue in addition to taxes, including license fees, fines, federal grants such as funds from LEAA, revenue sharing, payments made in lieu of taxes under the Taylor Grazing Act, etc. The actual amount of expenditure financed by taxation varies from county to county. Powder River County finances over 90% of its expenditures by tax revenues. In Sanders County the figure was approximately 28%. The state-wide average is approximately 50%. To obtain a more accurate picture of mill levies for county purposes in Rosebud County, cut the reported millage rates of Tables T and U in half. Thus, the estimated county mill levy of 46.52 mills reported in Table T for fiscal 1981-82 may be closer to 23.26 mills. The total mill levy, including the 46-mill state-wide assessment, would be 69.26 mills. This can be done for each of the entered millage rates for county purposes.

The purposed in presenting these tables was two-fold: First the addition of generating plants and increased production will significantly raise the taxable valuation of the county. In doing so, it is possible for mill levies (for certain governmental and school districts) to decline. Currently (fiscal 1974-75), the mill rate for Rosebud County purposes is 34.384 mills and 88.184 mills for all county-wide assessments. Second, the tables indicate the effect of expenditure changes on mill levies. It is not claimed that Rosebud County will experience expenditure changes exactly like those illustrated in the tables. Changes in expenditure patterns rest with the officials and citizenry of Rosebud County. However, there is a need for increased spending. When and how this spending occurs will affect tax rates.

To speak of levies of 10-12 mills at the county level, as does the Westinghouse Report (1973) is premature. Actual expenditures, operating costs, taxable valuation, and other factors will enter the picture and affect tax rates.

The State of Montana, Rosebud County, and the Colstrip school districts have the most to gain by the increased taxable valuation of the project. Other school districts within Rosebud County or the city of Forsyth will receive little direct benefit. Under the

existing tax structure, a governmental unit or school district can only levy property taxes against property within its geographical boundaries. This excludes Forsyth and other Rosebud County school districts from directly taxing the plants. For these districts the avenue to higher taxable valuations is indirect, primarily through increased allocations from the State Department of Revenue (if any) and taxes on the property of new businesses, homes, etc., that may be related to the Colstrip projects. For the city of Forsyth such additions will probably not be sufficient to cover needed capital outlays and higher operating costs. The city already faces repairs that are estimated to cost in excess of 4 million dollars. Thus far, the Colstrip project has had an adverse impact on Forsyth's service capacity, and the future promises little improvement.

Little has yet been said about the town of Colstrip. As part of a privately owned, unincorporated community, Colstrip residents do not pay taxes for municipal services. However, it would be prudent to assume that Colstrip residents will pay some form of municipal taxes in the future. On January 12, 1975, MPC President George O'Conner on the television program "Face the State" indicated that Western Energy Company intended to turn the town over to its residents after it had stabilized. Presumably that time will be after Units 1 and 2 are operational. The exact tax rate of Colstrip as a municipality is open to question, for at present, there are too many unspecified variables. Some important questions are: How much taxable valuation will Colstrip contain? Will the city have to purchase existing service systems, such as water and sewer lines, or will Western Energy donate them to the town? Will the services need expansion or repair? How large will Colstrip be? Will the city provide its own services, or will it contract them to another entity, such as Western Energy?

If one assumes that Colstrip will attain the size of Forsyth, Baker, or Hardin, operating its own public services, an estimate of 50-65 mills for municipal services may be a reasonable estimate. This millage estimate is premised on the idea that the generating units will be located outside the city limits. If the past is any indicator of the future, there is no reason to suspect the power

plants will be within the city limits. In Montana, few major industrial properties are located within city boundaries. The smelter at Anaconda is outside the city limits, as are the Great Falls reduction works, the weed concentrator at Butte, the Exxon and Continental refineries near Billings, and the Montana Power Corette steam plant near Billings. The five Montana Power dams and hydroelectric plants located near Great Falls are also outside city boundaries. If the generating units are not within its city boundaries, Colstrip will be required to finance city services with a taxable valuation of a few million dollars, principally from residential and commercial property.

In this and the preceding sections the focus has been directed at the costs of governmental services and taxation. The future projections of expenditures, tax rates, and taxable valuations are premised on certain assumptions and are valid only to the extent those assumptions are valid. The situation in Rosebud County could be radically altered. For example, a large part of the estimated taxable valuation of the county depends on coal production and its value. If the value of coal declines or if production is interrupted, the taxable value of the product and, ultimately, the county will decline accordingly. The projections of taxable valuation do not take such factors into account. As such, the projections offered here may not strictly meet the actual situation a few years in the future.

13. <u>Monitoring</u>, p. 998

Further information is needed from the applicants concerning future monitoring plans and programs for Units 3 and 4. This information will be examined by the Department as it is received.

Bibliography, p. 1041

Insert immediately after the first entry on page 1041:

"U.S. Department of Labor. Dictionary of Occupational Titles. 1965."

Immediately after the entry beginning "U.S. Forest Service..." insert:

"Van Eeckhout, G. 1974. Movement, reproduction and ecological relationships of channel catfish in the Little Missouri River, North Dakota, 1972-73. Unpubl. thesis (M.S.), U.N.Dak."

Credit, p. 1049

Following "Impacts on Vegetation: C.C. Gordon, Philip Tourangeau," insert:

"Impacts of Phytotoxins on Reclamation Species: Sharon M. Solomon"

VOLUME 3b POWER PLANT APPENDIXES

Appendix C1, p.3

In the fourth line of the first paragraph, delete "(Ross, Andrews and Witking 1958)" and substitute "(USGS 1955)".

Appendix C1, p. 23

Delete the last paragraph.

VOLUME 4: Transmission Line

3.1.1. Line Reliability, p. 15

It was commented that this section, and all subsequent discussion in the draft impact statement, should have employed the term "system reliability" rather than "line reliability." System reliability includes consideration of generation, transmission lines, and substations. To limit the context to the transmission lines themselves, the term "line reliability" was used.

3.1.1., p. 17 (Table 3-2)

Table 3-2 is reprinted, with additions, on the following page.

3.2.2.2. A.C. Transmission, p. 30

It should be noted that, in the last paragraph on page 30, the underground transmission discussed includes only that carried over distances greater than 40 miles. Underground transmission at shorter distances is often more economically feasible and does not always involve the technical problems mentioned in this section.

3.2.2.2., p. 32 (Figure 3-14: Transformers)

The transformer on the right should be labelled "Single Phase Shell Type" rather than "Single Phase Core Type."

3.2.3. Overhead and Underground Transmission, p. 35

For the purposes of the discussion in this section, line distances of greater than 40 miles were assumed.

TABLE 3-2

FORCED OUTAGES ON 500, 230, and 115 KV BPA TRANSMISSION SYSTEMS (OREGON, WASHINGTON, AND WEST OF CONTINENTAL DIVIDE) IN 1973

Voltage	Total Number of Lines	Total Outages	Total Time Lost in Outages	Number of Outages Due To: Lightning	Fire	Terminal Eq. Failure	Overload	Accidental Tripping	Other
500 KV	28	90	192 hrs[1]	10	-	11	-	13	56
230 KV	90	139	442 hrs	47	4	9	3	20	56
115 KV	160	150	1,583 hrs[2]	43	2	4	13	5	83

[1] This includes one incident of malicious damage which resulted in a time loss of 11 hours.

[2] This includes eight incidents of malicious damage (one of which alone resulted in a time loss of 1,209 hours) which accounted for 1,256 hours of this total.

(BPA 1974)

3.2.3.2. A.C. System, p. 37

In the first line of the first column, "rejection" should read "conduction". In the seventh line, delete "or sheath".

3.2.4.2. Changes Expected In Three Years, p. 44

In the fifth line of this section, "liquid" should read "gas".

3.4.1.1. Power Delivery Point, p. 56

At the public meetings held by the Department, some participants asked why the draft impact statement considered transmitting power from only one source (Colstrip) to only one terminal (Hot Springs). Hot Springs was considered as the terminal because of the existence of a federal (Bonneville Power Administration) 500 KV transmission line from Hot Springs west. Bonneville Power Administration could wheel the power from there. Any other terminal would require additional construction (and corridor establishment) westward, both within and without the state.

3.4.2. Alternative Routes, pp. 58-60,62 (Figures 3-22 through 3-25)

The following legend should be added to each of these figures:

500 KV LINES

230 KV LINES

LOAD CENTERS

ELECTRICAL POWER FLOW IN MEGAWATTS

4.1. <u>Design Criteria</u>, p. 67 (Table 4-1)

In Footnote 1, "conduction" should read "conductor".

4.2.2. <u>Tower Body and Foundation</u>, p. 71

At the public meetings on the Colstrip project held by the Department, many participants, especially landowners, expressed concern about which of the two tower structures, self-supporting and guyed, proposed by the applicants would be used on agricultural land. Though the construction plans call for approximately 80% guyed towers, no guyed towers are planned for agricultural land.

4.4. <u>Electrical Characteristics of the Proposed System</u>, p. 77

In the list of conductor characteristics in the second column, "X_C = .1181 megaohms/mile" should read "X_C = .1181 megaohm-miles".

4.4.1. <u>Corona Effect</u>, p. 78

In the fifth line of the first column, "When A.C. current is carried in a conductor" should read, "When A.C. voltage is applied".

4.4.2.1. <u>Radio Frequency Interference (RFI)</u>, p. 82 (Table 4-3)

The third column in Table 4-3, under "Minimum Signal Level," should read as below:

Minimum Signal Level
1500 μv/m (microvolts per meter)
500 μv/m

In the second and fifth lines of the partial paragraph below Table 4-3, "mv/m" should read"μv/m".

4.4.1.1. Audible Noise, p. 84 (Figure 4-11)

In the title, delete "AN" and substitute "AUDIBLE NOISE". Add below the title: "N = number of conductors per phase".

4.4.2. Radio and Television Interference, Radio/TV Reception map opposite page 86

The following legend should be added to the Radio/TV Reception Map:

LEGEND

Mapping numbers below correspond to the numbers at transmitter locations and on coverage-area lines. Stations listed in the legend which do not appear on the map did not submit coverage-area information by the deadline for printing of this impact statement.

Television Stations In Montana

Mapping Number	City	Station
1	Butte	KXLF-TV
2	Glendive	KXGN-TV
3	Great Falls	KFBB-TV
4	Great Falls	KRTV
5	Helena	KBLL-TV
6-1	Kalispell	KCFW
6-2	Missoula	KGVO-TV
6-3	Butte	KTVM
7	Billings and Miles City)	KTVQ
8	Billings	KURL
9	Miles City	KYUS

Radio Broadcasters In Montana

Mapping Number	City	Station
10	Anaconda	KANA
11	Baker	KFLN
12	Belgrade	KGVW
13	Billings	KBMY
14	"	KGHL
15	"	KOOK
16	"	KOYN
17	"	KURL
18	Bozeman	KBMN
19	"	KXXL
20	Butte	KBOW
21	"	KXLF
22	Dillon	KDBM
23	Glasgow	KLTZ
24	Glendive	KGLE
25	"	KXGN
26	Great Falls	KARR
27	"	KEIN
28	"	KMON
29	"	KUDI
30	Hamilton	KLYQ
31	Hardin	KHDN
32	Havre	KOJM
33	Helena	KBLL
34	"	KCAP
35	Kalispell	KGEZ
36	"	KOFI
37	Lewistown	KXLO
38	Libby	KLCB
39	Livingston	KPRK
40	Miles City	KATL
41	Missoula	KGMY
42	"	KGVO
43	"	KYLT

Radio Broadcasters In Montana
(continued)

Mapping Number	City	Station
44	Missoula	KYSS
45	Plentywood	KPWD
46	Red Lodge	KRBN
47	Shelby	KSEN
48	Sidney	KGCX
49	West Yellowstone	KWYS
50	Wolf Point	KVCK

4.4.2.2. <u>Television Interference</u> (TVI), p. 86

Among the causes of TVI discussed in this section are gap-type discharges. The applicants have stated in their comments to the Department on the draft impact statement that they are committed to eliminating any such discharging on the proposed line.

4.4.3. <u>Electrostatic and Electromagnetic Induction</u>, p. 91

It has been commented by Bonneville Power Administration that the draft impact statement does not deal with the question of inductive coordination of the lines with wire telecommunication facilities. The occurrence of this phenomenon is heavily dependent on centerline selection; Bell Telephone would be represented during the centerline selection process.

4.4.3.2. <u>Capacitive Coupling</u>, p. 96 (Figure 4-21: Effects of Current on Humans)

The label "TIME UNITS" above the title, and the accompanying numerals 1-7 along the x-axis of the graph, should be deleted.

5.1.1.3. Seismicity, p. 101

The applicants believe that the proposed transmission towers are resistant to earthquake damage and cite a reference (Long 1973) to support this claim. Long's paper analyzes only the acceleration upon idealized self-supporting towers. Large guyed towers such as those proposed for the 500 KV transmission line in Montana were not considered.

In addition, Long's paper underestimates the acceleration potential for moderate earthquakes. The San Fernando earthquake of 1971 (magnitude 6.6) produced accelerations of .50 to .75 g (with a few peaks equal to 1.0 g) for a period of about 12 seconds (National Academy of Sciences 1971). Palk and Hanson (1974) report a 6.4 magnitude and peak acceleration between 0.3 and 0.5 g for the same earthquake. Earthquakes of approximately this magnitude have occurred in western Montana and will likely occur again during the projected life of the transmission lines. The effects of strong accelerations upon an actual guyed tower in an earthquake may be quite different from the idealized situation discussed in Long's paper.

Table 11-2 in the summary volume of the EIS points out how earthquake damage may be compounded by ground movement, rock slides, and other phenomena. Most of the damage to transmission facilities in the San Fernando earthquake was caused by landsliding. More than 1,000 landslides and rockslides ranging in length from 50 feet to over 1,000 feet occurred in that shock (Palk and Hanson 1974). Historic Montana earthquakes have also produced damaging landslides and rockslides. Transmission towers which may withstand the vibration of an earthquake may nevertheless be destroyed by secondary events which accompany most large shocks.

Palk and Hanson (1974) state that equipment should not be guyed in such a way that the lines could slacken and then become taut, an occurrence which results in high-impact forces. The acceleration that the proposed guyed towers could withstand before failing has not been quantified by the applicants. The Department

is unaware of any consideration given by the applicants or their contractors to the seismic safety of the proposed transmission line, although transmission systems can and have failed as a result of earthquakes, and although western Montana is a seismically active region.

5.1.3.3. Data Interpretation (Soils), pp. 123 and 124

Delete the soils unit lists headed "Soils of the Mountains," "Soils of the Foothills," "Soils of the Plains," "Soils of the Basins," and "Soils of the Alluvial Lands" on pages 123 and 124. Substitute for them the following lists:

Soils of the Mountains

1) Soils developing in material weathered from noncalcareous consolidated rocks other than granite on very steep or steep mountain slopes with significant outcrops of bedrock; in material weathered from permeable limestone bedrocks on steep or very steep slopes containing inclusions of rock outcrops;

2) Soils developing from material weathered from noncalcareous rocks other than granites on steep or very steep mountain slopes (in areas of higher precipitation than in #1); in material weathered from calcareous rocks in the Belt Group on steep to very steep mountain slopes; in material weathered from Boulder Batholith granites on steep to very steep slopes;

3) Soils developing in fine textured glacial deposits in steep mountain valleys and in material weathered from limestone bedrock on very steep mountain basins.

4) Soils developing in loamy or clayey material weathered from shales and siltstones in moderateley steep to steep mountain basins;

5) Soils developing in loamy material weathered from consolidated bedrock on very steep alpine ridges and adjacent subalpine slopes.

Soils of the Foothills

1) Soils developing in loamy material weathered from sedimentary and basic igneous rocks on moderately steep to steep uplands and steep lower valley sideslopes;

2) Soils developing in gravelly alluvial deposits of tertiary age on nearly level to moderately sloping high benches, alluvial fans and steep escarpments; in loamy material weathered from sedimentary rocks on moderately sloping to steep plateaus and high ridges; in clayey sediments and silty lacustrine deposits on nearly level benches and steep escarpments;

3) Soils developing in loamy material weathered from sedimentary rocks on steep to very steep hogback ridges;

4) Soils developing in gravelly alluvial deposits in high precipitation areas on nearly level to moderately sloping high benches and alluvial fans; in loamy or clayey material weathered from soft shales and siltstones on nearly level to moderately steep uplands.

Soils of the Plains

1) Soils developing in materials weathered from sandstones and shales on nearly level benches.

2) Soils developing in materials weathered from shales on moderate to steep uplands;

3) Soils developing in material weathered from shales on steep to very steep and highly dissected badlands;

4) Soils developing in loamy to clayey materials weathered from interbedded steeply dipping sedimentary rocks.

5) Soils developing in material weathered from interbedded sediments on well dissected uplands, narrow level ridge tops and steep valley slopes.

6) Soils developing on clayey material weathered from interbedded sedimentary rocks.

Soils of the Basins

1) Soils developing in stratified alluvial deposits on nearly level alluvial fans and high stream terraces; in sandy and gravelly glacial outwash deposits on nearly level outwash terraces and fans and steep terrace escarpments, in silty alluvial fans and stream terraces;

2) Soils developing in volcanic ash-capped glacial till deposits on moderate to steep uplands.

Soils of the Alluvial Lands

1) Soils developing in highly stratified alluvial deposits on stream floodplains and low terraces;

2) Soils as in 1) above, but with significant areas of shallow watertables.

5.1.4.1. Existing Vegetation Types, p. 128

In line six of the second paragraph in the first column, insert "wheatgrass" after the first incidence of the word "western".

5.2.1.1. Land Use Categorization, p. 161

Add this paragraph just before "2. Utilities" in the second column:

The private airstrips--Black Bear (T22N R14W), Holbrook (T21N R13W), Big Prairie (T20N R13W), and Basin Creek (T19N R12W--are no longer maintained for air traffic; these strips, designed for restricted use, are not available for non-emergency use.

5.2.1.1., p. 161

In the second column, seventh and eighth lines from the bottom of the paragraph under "a. Electric Transmission Lines," delete "because the problems of maintenance are more severe".

6.1.1.2. Other Geologic Impacts, p. 181

In the first column, in the second line of the paragraph under "B. Operational Impacts", "absorb" should read "adsorb".

6.1.4.2. Operation, p. 194

In the fourth line from the bottom of column one's only complete paragraph, substitute "dieback" for "tieback".

6.1.4.3. Maintenance, p. 196

Delete the last sentence of the first complete paragraph in column two, substituting for it: "Examples of these species are Kentucky bluegrass and sweetclover."

6.1.5.6. Other Impacts, p. 202

In the first line of the second column, "do not use" should read "do use".

6.1.6.2. Operation, p. 205

In the last line of the first partial paragraph in the second column, a superscript "6" should be inserted immediately following"...a moderate temperature inversion (p. 37)."

6.2.1.1. Agricultural Land Uses, p. 206

In the last paragraph in the second column, sixth-from-last line, the following sentences should be inserted following "...a corridor one mile long.":

The figures in Table 14 of Appendix M are based on the assumption that the entire 300'-wide corridor would be taken out of production. Normally this would not be the case, since most of the land beneath the lines would continue to be farmed; only the 810 square feet enclosed by each tower base would be completely taken out of production. On relatively flat land there would be four towers per mile, for a land loss of 3,216 square feet per mile, significantly less than if the total corridor acreage were taken out of production.

6.2.1.4. Archaeologic and Historic Sites, p. 209

The following paragraph should be inserted following the only paragraph in this section (last paragraph in first column):

Many laws concerned with preservation of antiquities provide protection of archaeologic and historic sites. The Antiquity Act of 1906, the Historic Sites Act of 1935, the Historic Preservation Act of 1966, Executive Order 11593, and the National Environmental Policy Act of 1969 provide funds and objectives for federal involvement in preserving, restoring, and maintaining the historic and cultural environment of the nation. The Montana Strip Mining and Reclamation Act and the State Antiquities Act also address the problem of historic and archaeologic sites inventory, evaluation and preservation. Legally, the sites, of whatever description, are protected, but neither known nor newly discovered sites have been evaluated. If a corridor is selected, there will need to be an archaeologic/historic survey by professionally qualified and acceptable personnel prior to corridor development.

6.2.1.5. Aesthetic Impacts, p. 209

Transmission lines crossing open, nonobstructed landscapes initiate the breakdown of a large space into two smaller spaces; the towers and conductors imply two spaces because they become an edge condition or boundary which visually marks the terminal extent of one space and the beginning of the next.

The breakdown of the large spaces or landscapes caused by the presence of transmission lines is not complete because of the visual transparency inherent in line and tower structures, but the existence of the lines implies a spatial division. This partial division has been articulated as landscape "clutter" or "obstructions" in a view, which indicates that an individual senses a spatial ambiguity in addition to other reactions.

Impacts have been accepted as a necessary blemish on the land, just as wooden pole transmission structures and fences have been. For a state noted for its "Big Sky" and associated large open spaces, the addition of more transmission lines would further subdivide the large spaces into smaller landscapes.

6.5. Summary of Transmission Line Impacts on Natural and Cultural Systems

A comment has been received which states that transmission lines "... can be built with less erosion than that caused by plowing similar acreage in fields." In reality, the environmental impact of the development and maintenance of 500 KV transmission lines is not a simple issue which can be compared to plowing or any other similar kind of action. There are a great many habitat types, soils, kinds of geology, and climates that occur in the area between Hot Springs and Colstrip. Different combinations of these factors will produce varying impacts during construction and maintenance of the lines.

There are two basic levels of impacts associated with these kinds of developments:

1) Immediate impacts resulting from road and tower development; and

2) Long-term impacts resulting from maintenance of the line and presence of the road system.

The following chart roughly summarizes some of these impacts:

Base Resource	Resulting Impacts/1
Soil Resource--disturbance from road and tower construction are major causative actions.	
1. Construction and maintenance on steep slopes, shallow, very fine or coarse textured, highly erosive soils	Higher probability of mass movement (-) Increase in suspended sediment in streams (-) Increase in nutritive levels in surface water (+ or -) Increase in surface water temperature (-) Soil erosion (-)
2. Construction and maintenance on nearly level slopes, medium textured, low erosion potential	Greatly reduced probability of significant impact on soils and associated resources (+ or -)
Vegetation Resource--road and tower construction and right-of-way maintenance. 1. Rangeland areas	Loss of range and livestock production in area occupied by roads and towers (-) Very slow regeneration of native plant species and communities (-)

/1 the (+) or (-) indicate a gross evlauation of the resultant impact, whether positive or negative in its effects.

2. Forested areas	Loss of timber production in areas of permanently maintained rights-of-way (-) Change from forest to shrub communities increasing wildlife forage potential (+) Corona and ozone impacts on timber production (-)
Hydrologic and general watershed resource--road and tower construction are major causative action	Some increase in peak flow and total water yield (-) Increase in suspended solids, chemical oxygen demand, water temperature (-)
Wildlife Resource	Some bird line casualties (-) Forest-to-shrub type change with added capacity for forage production (habitat change) (+) Increased access by man resulting in higher hunter harvest and potential disturbance (+ or -)
Agricultural Land Use	Tower placement creating point rows and other difficulties in cropland agricultural production (-) Loss of agricultural or timber production in area occupied by tower and maintenance road (-) Spinoff industrial and urban development encroaching on agricultural lands (-)

Human and Associated Resources	Interference with TV and other communications (-) Visual and aesthetic considerations (-) Increased access to backcountry (+ or -)

Bibliography, p. 272

Immediately after the fourth entry ("Federal Power Commission's Advisory Committee..." on this page, insert:

Federal Power Commission. The 1970 National Power Survey. U.S. Government Printing Office, Washington D.C., 1970.

Bibliography, p. 275

Immediately after the second entry ("Hunt, R.D...."), insert:

Institute of Electrical and Electronic Engineeers Radio Noise Subcommittee. "Radio Noise guide for High-Voltage Transmission Lines." IEEE Trans. Power Apparatus and Systems, (March-April 1971), 883-842.

On the same page, just before the last entry ("Kitchings, J.T..."), insert:

Kimbark, Edward D. Direct Current Transmission, Vol. 1. New York: John Wiley and Sons, 1971.

Bibliography, p. 284

Immediately after the fifth entry (the last on beginning "U.S. Department of Commerce."), insert:

U.S. Department of Interior, Bonneville Power Administration. Celilo: Northern Terminal Pacific HV-DC Intertie. 1970

Bibliography, p. 286

Immediately after the entry beginning "Weidman, R.M.," insert:

Wellman, W.R. <u>Elementary Electricity</u>. Princeton, N.J. D. VanNostrand Co, Inc, 1959

Appendix I1, p. 291

In the list of definitions of elements in the equation, two-thirds of the way down the page, delete the definitions of $\overline{Eg}$, $\overline{Em}$, and X, and substitute:

$\overline{Eg}$ = internal voltage of generator (line to line) in volts

$\overline{Em}$ = internal voltage of motor (line to line) in volts

X = reactance between internal voltages of generator, transformers, and motor, including transmission lines, in ohms/phase.

Appendix I1, p. 292

In the last line, delete "A must be $\geq$A'" and substitute "A must be $\leq$A'".

Appendix I6, p. 308

In the list of value definitions near the beginning of the page, delete:

"G_m = critical voltage gradient theoretical average value"

and substitute:

"G_m = maximum voltage gradient theoretical value"

Near the bottom of the page, in the first equation under "a.

Method I", the fourth term of the right side of the equation ("40 log $\frac{d}{3.53}$") should read "40 log ($\frac{d}{3.93}$)".

Appendix I6, p. 311 (Table 1)

In the third major column heading at the top of the page, insert a superscript "1" immediately after the Roman numeral II. Below the table, at the bottom of the page, insert:

[1]Test location and assumptions were different for Method II than for Method III

Appendix I6, pp. 312 and 314

There are numerous corrections to be made in the equations printed on these two pages. They have been reprinted, with corrections, on the following pages.

Appendix I6, p. 329

In item number 2, "well-insulated" refers to a vehicle on rubber tires without chains.

B. Worst Case Electrostatic Effects Calculations

1. Inductive Coupling

Figure 1 shows the position of conductors for the two proposed lines, and the position in relation to the conductors of the four fences for which calculations were made.

a. Fence #1

The fence was assumed to be located midway between the two power lines.

$$V_{oc} = -j(.2794) \quad I_1 \log D_{IF} + I_2 \log D_{2F} + I_3 \log D_{3F}$$

$$+ I_4 \log D_{4F} + I_5 \log D_{5F} + I_6 \log D_{6F} \qquad \text{(Westinghouse 1964, p. 748)}$$

(This replaces page 312 of Volume 4 of the draft impact statement.)

where all logarithms are base 10.

$$D_{1F} = \quad (56 + 37)^2 + (37-4)^2 \quad {}^{1/2} = 98.68 \text{ ft.}$$

$$D_{2F} = \quad (56 + 18.5)^2 + (37-4 + 32)^2 \quad {}^{1/2} = 98.86 \text{ ft.}$$

$$D_{3F} = \quad (56^2 + 33^2) \quad 1/2 = 65 \text{ ft.}$$

$$D_{4F} = D_{3F} \qquad D_{5F} = D_{2F} \qquad D_{6F} = D_{1F}$$

$$V_{oc} = -j(.2794) \quad (2000 \,\underline{/\, 120^0}) \log 98.68 + 2000 \,\underline{/-120^0} \quad \log 98.86$$

$$+ 2000 \,\underline{/0^0} \log 65) + 2000 \,\underline{/0^0} \log 65) + 2000 \,\underline{/-120^0} \log 98.86$$

$$+ 2000 \,\underline{/120^0} \log 98.68 \qquad \text{volts/mile}$$

$$= -j(558.8) \quad (-.5 + j.866) (\log 98.68 + \log 98.68)$$

$$+ (1) (\log 65 + \log 65) + (-.5 -j.866) (\log 98.68 + \log 98.86)$$

$$= -j(558.8) \quad (-.5 + j.866) (3.99)$$

$$+ 3.625 + (-.5 - j.866)\ (3.99)$$

$$= -j\left(\frac{1117.6}{2}\right) \quad -1.995 + j\ 3.45 + 3.625 - 1.995 - j3.45$$

$$= -j\left(\frac{1117.6}{2}\right) \quad -.365 + 0$$

$$= \ j\left(\frac{407.92}{2}\right) \text{ volts/mi}$$

or $$V_{oc} = \frac{407.92/9^0}{2} \text{ volts/mi}$$

Because fences generally do not parallel lines for a full mile, and because the 2000 amp current will generally not exist in the conductor all the time, a correction factor of .25 has been applied to this worst-case value to give an average-case value:

$$V_{correction} = 203.96\ \underline{/90^0} \times .25 = 50.99\ \underline{/90^0}$$

(This replaces page 314 of Volume 4 of the draft impact statement.)

b. Worst Case Calculations

Calculated values for V_{oc} and $V_{correction}$ for three other fence positions are given Table 2.

Table 2

Fence Position	V_{oc}	$V_{correction}$
#1 - fence between conductors 3 & 4	203.96 $\underline{/90^0}$	50.99 $\underline{/90^0}$
#2 - fence under conductor 4	155 $\underline{/110^0}$	39 $\underline{/110^0}$
#3 - fence under conductor 6	107 $\underline{/175^0}$	27 $\underline{/175^0}$
#4 - fence 60' from conductor 6	48 $\underline{/201^0}$	12 $\underline{/201^0}$

FOOTNOTES

1. The mean ratio of observed to calculated plume rise values for these four plants was 0.72 for stable conditions.

2. One possible source of error in Briggs' equations are the numerical constants used in them (e.g. the constant 2.9 in the equation for the final rise in a stable atmosphere: $\Delta h = 2.9\ (^{F}/us)^{1/3}$. These constants were derived using an empirical entrainment constant for bent-over plumes and an average empirical correction factor calculated from a comparison of observed and predicted plume rise (Briggs' 1969). For any single plume the average correction factor may not be correct.

3. The lower boundary of the actual layer would be the top of the stacks, and this height for the proposed units would be 160 m (525 ft.), not the 90 m (294 ft.) used in the calculations.

4. The draft long-term Gaussian model predicted an increase in total suspended particulate concentrations due to Colstrip Units 1-4 to be about 1 $\mu g/m^3$ annually. (Table 11-4 pg. 666 Volume 3b) Table 10-5, p. 297-298 of Volume 3a lists background particulate concentrations to be about 10 $\mu g/m^3$ (geometric mean of the Nov. '73 to June '74 period).

5. The annual emission rates for the 1.6μ (aerodynamic size) and smaller particles are based upon Table G and Table H emission rates.

6. For this same reason, no attempt to quantitatively estimate the magnitude of the overprediction of the dilution model due to points 1 and 2 above was necessary.

7. The 0.44 exponent compares favorably to the value of 0.5 suggested by Hino (1968).

8. Figures B and C in the section on Gaussian short-term model results in this final EIS give the stratifications of the horizontal

and vertical dispersion coefficients as functions of meteorological parameters derived by MSU from the Colstrip data since the draft statement was released. These stratifications do not limit the horizontal and vertical coefficients as represented by lines A through F and A through G, respectively, to strict one-to-one correspondences. An examination of the Colstrip meteorological data tape for the period 12/1973 to 5/1974 indicates that multiple pairing does in fact occur.

9. The B-C and C-D lines in Figure B were not drawn by MSU. They were drawn by the Department to represent the B-C and C-D categories in MSU's stratification.

Section III: PUBLIC COMMENT

A. THE PUBLIC COMMENT PERIOD

A public comment period on the draft EIS was conducted from November 25, 1974 to January 9, 1975 (See Section 12.4.4., Volume I, Draft EIS). During this time a total of 13,756 individual responses from the general public were received by the Department of Natural Resources and Conservation.

Comment was received verbally from 479 persons testifying at public meetings conducted by the department; 540 responses were received in the form of individual letters and postcards; 832 public responses came in the form of telephone calls to the Montana Citizen's Advocate office, and 11,905 responses were represented by names on petitions.

The following section is a general discussion of this public comment.

B. PUBLIC MEETINGS

1. General Discussion

Nineteen public meetings were conducted by the Department in selected communities across Montana. The purpose of the meetings was to provide information to the general public on the draft EIS concerning the Colstrip proposal, as well as to gather public comment on the draft statement. The meetings were well attended and usually were covered by the press.

In order to provide information on the proposal, the Department developed an audio-visual program summarizing the preliminary findings contained in the draft EIS. The program was shown at the beginning of each public meeting. In addition, copies of Volume I, Summary, of the draft EIS were distributed at the meetings to any participant who wished to obtain one.

Following the audio-visual program, public comments were taken from the floor. In addition, representatives of each of the five applicant companies made public statements at each of the nineteen meetings(see Section B). The public comments were recorded, and summaries of the comments were given to the EPD technical staff on a regular basis. Although there was a wide variety of public comment, two generalizations can be made.

First, instead of addressing specific items, errors or omissions in the draft EIS, a substantial majority of the participants used information contained in the impact statement, or information from other sources, to validate arguements as to whether, in their opinion, the proposal should be approved or denied. In other words, the meetings were utilized by the public as a forum to discuss the advisability or inadvisability of the proposal. In this public discussion, most participants perceived the application as a political issue, and interpreted that issue in strict "black-or-white" terms. That is, the vast majority of the participants either advocated complete approval and certification of the proposal, or called for a flat denial. The reasons for these opinions varied greatly.

Second, many persons or groups with a special interest in the proposal apparently used the meetings as a forum to influence the opinion of others. Typically, a particular person would deliver identical or very similar comments at a number of different meetings. These comments were apparently not directed to either the Board or Department of Natural Resources and Conservation as much as they were to the general public at large. For this reason, a distinction has been made between the comment of local residents of a given community, and the comment of interested persons or groups that "followed" from meeting to meeting.

The following is a brief general description of each meeting, in chronological order. It should be remembered that these summaries merely reflect the general tone of the meetings in light of the fact that most participants advocated either approval or denial of the proposal. Specific technical comments on the draft EIS itself are not covered here, but were reported to appropriate Department personnel for consideration in developing the final EIS.

2. Summary of Meetings

PLAINS, November 25, 1974, Plains High School Auditorium

The meeting in Plains was attended by approximately 55 persons, 27 of whom made public comments. Generally, the transmission line portion of the proposal was the major concern of the local residents. Of particular concern were negative impacts associated with transmission lines, such as electromagnetic effects and land taken out of production. Also, of concern was whether the Bonneville Power Administration intends to build an additional transmission line from Hot Springs east if Colstrip Units 3 and 4 are approved.

OVANDO, November 26, 1974, Ovando Grade School Gymnasium

Approximately 65 persons were present at the meeting in Ovando, and 17 of them made public comments. Again, the

transmission line portion of the proposal was the major concern, although there were a few comments addressing the power plant as well. Local participants were almost exclusively ranchers, whose concerns generally involved possible reduction of land values due to the proposed transmission lines, as well as aesthetic considerations.

The speakers were nearly equally divided between those supporting the proposal and those opposing it.

ANACONDA, December 2, 1974, Anaconda Jr. High School Auditorium.

The meeting in Anaconda was a departure from the normal pattern. A total of 30 persons attended, and only two made public comments. One was a statement against the proposal delivered by an affliate of the Northern Plains Resource Council, a citizen's group headquartered in Billings. The other was a question asked by a local resident concerning electromagnetic effects of high voltage transmission lines.

BUTTE, December 3, 1974, East Jr. High School Auditorium.

The meeting in Butte was attended by approximately 250 persons, 14 of whom made public comments. Most were in favor of the proposal, mentioning economic growth, employment opportunities and increased revenues from taxation. A majority of the speakers were members of the business community, representing large and small businesses with a majority of the remainder reflecting organized labor, construction contractors and local educational institutions.

HELENA, December 4, 1974, Helena Jr. High School Auditorium.

The meeting in Helena was attended by approximately 500 persons, 34 of whom made public comments. Participants were almost equally divided between those supporting and those opposing the proposal. Numerous detailed comments were submitted from representatives of special interest groups or businesses.

In general, representatives of the business community supported the proposal, while those opposing it were primarily local landowners or local residents without overt business ties. Reasons given in support of the proposal included economic growth, increased revenue from taxation and increased employment opportunities. Reasons given in opposition to the proposal included adverse impacts to the natural and cultural environment and predictions of a population influx. Many who opposed the proposal expressed the opinion that the project, if approved, would serve as a precedent for further industrial development in Montana. These persons regarded further industrial development as undesirable.

GREAT FALLS, December 5, 1974, West Jr. High School Auditorium

Twenty-nine public comments were received from the approximately 150 persons attending the meeting in Great Falls. Of the local residents who spoke, a majority favored the proposal. Again, proponants of the project generally represented business interests or organized labor, citing increased economic growth, employment and taxation as reasons. In addition, several participants expressed concern about a possible shortage in petroleum, and a resultant increase in demand for electricity. An increase in demand for electricity for irrigation was also cited.

Those opposed to the proposal included local residents without overt business ties and local educators. In addition, many young persons spoke against the proposal.

BOZEMAN, December 9, 1974, Emerson School Auditorium

Approximately 165 persons attended the meeting in Bozeman, 31 of whom made public comments. Generally, the majority of local residents who spoke were opposed to construction of the power plants, although there was a large minority in support. A significant number of people voiced the opinion that a moratorium should be placed on certification of Units 3 and 4 until the impacts of Units 1 and 2 can be more fully evaluated.

Those advocating approval of the proposal gave several reasons, including anticipated electric load growth for irrigation and the possibility of mass conversion to electric heating in the event of a shortage in natural gas. Those against the proposal cited adverse impacts, concentrating on air pollution and the fear of a concurrent industrial development and population influx in Montana.

BIG TIMBER, December 10, 1974, Sweet Grass County High School Auditorium.

The meeting in Big Timber was attended by approximately 75 persons, of whom 17 made public comments. Of the local residents who spoke, there was almost unanimous approval of the proposal. Among the reasons cited were employment opportunities, increased tax revenue and economic growth. Shipping the coal for use at the load conter was criticized because it would use additional fuel oil, which participants felt would soon become scarce. Many voiced the opinion that present environmental standards as fixed by law are adequate. Some of the speakers were ranchers, with business and organized labor also represented.

HARLOWTON, December 11. 1974, Harlowton High School Gymnasium.

Twenty-two public comments were received from the approxmately 120 persons attending. A definite majority of local residents who spoke were opposed to the proposal. These were nearly all local ranchers, and reasons given for their opposition included adverse impacts, pollution and the opinion that public need for the proposed plants has not been demonstrated. Strong sentiment was expressed in favor of shipping Montana coal by rail for use at the load center. Comments were generally equally divided between opposition to the power plant and opposition to the transmission line portion of the proposal. Many voiced the opinion that the project would serve as a precedent for further industrial development in Montana, which was regarded as undesirable.

The minority favoring the proposal, generally cited increased energy needs in the United States, increased electrical loads due to irrigation, and the opinion that present environmental standards are adequate.

TOWNSEND, December 12, 1974, Townsend Elementary School.

The meeting in Townsend was attended by approximately 45 persons, 9 of whom made public comments. A majority of the local residents who spoke, all area ranchers, were against the proposal. Reasons given included adverse imapcts to agriculture, potential increased industrialization of Montana and the aesthetic appearance of transmission lines. There was substantial support of shipping Montana coal by rail for use at the load center.

The minority favoring the proposal cited economic growth and increased electrical loads due to irrigation. These proponants represented local electrical cooperatives and small businesses.

ASHLAND, December 15, 1974, Ashland Grade School.

Approxiamtely 75 persons attended the meeting in Ashland, 25 of whom made public comments. Every local resident who spoke was against the proposal. Many reasons were given, including adverse impacts to the local social environment due to a population influx; impacts of power plant emissions on agriculture, wildlife, humans, and timber resources; increases in local taxation prior to operation of the units, and impacts due to strip mining. The majority of the participants expressed the opinion that the proposal would serve as a precedent for further industrial development in the area, which was strongly regarded as undesirable. Strong sentiment was also expressed advocating a moratorium on Units 3 and 4 until impacts of Units 1 and 2 can be evaluated during operation.

CUSTER, December 16, 1974, Custer High School Gymnasium.

The meeting in Custer was attended by approximately 85 persons, of whom 28 made public comments. Local residents who spoke were almost equally divided between opposition to and approval of the proposal.

Most of those supporting the proposal were construction workers employed at Colstrip. Some stated they were long-term residents of the area, but most did not. Reasons given for their support emphasized employment opportunities and also included economic growth, increasing national energy needs, and the opinion that current environmental standards are adequate.

Those in opposition were all local ranchers and long-term residents. Reasons given included adverse impacts to agriculture from strip mining, power plant emissions, and transmission line towers; problems with taxation and social services in the area; and the opinion that industrialization would inevitably change the lifestyle of persons living in the area. There was a significant amount of opinion advocating shipment by rail of Montana coal. Public need was questioned, and the "boom-and-bust" economy attendant to the construction phase of the power plants was criticized.

There was considerable disagreement at the meeting concerning the present tax situation in Rosebud County.

HARDIN, December 17, 1974, Hardin High School.

The meeting in Hardin was attended by appoximately 85 persons, 27 of whom made public comments. The majority of local residents who spoke were against the proposal. Reasons cited were generally fears of adverse impacts to the natural environment. Although a few speakers lived in Hardin proper most speakers were area ranchers who were against the proposal. Hardin businessmen were not represented, with the exception of a local electrical cooperative which supported the project.

A large number of construction workers employed at Colstrip participated in the meeting, unanimously approving the proposal. In addition, several contractors and construction workers from Billings spoke in favor of the proposal. Reasons most often cited were employment opportunities, increased tax revenues and economic growth.

FORSYTH, December 18, 1974, Rosebud County Courthouse

Thirty-one public comments were received from the approximately 150 persons attending the meeting in Forsyth. A large number of both local ranchers and Colstrip construction workers were present.

The ranchers were almost unanimously against the proposal; those in opposition cited adverse environmental impacts, population influx, social disruption, and adverse impacts to agriculture. Many supported exporting Montana coal by rail, however, and others supported a temporary moratorium on Units 3 and 4 unitl the impacts of Units 1 and 2 can be observed operationally. There was a great deal of support for the idea that taxes paid by the applicants would not cover 100% of the cost of the proposal's local impacts. An overwhelming majority of local long-term residents who spoke expressed a feeling that Units 3 and 4, if approved, would serve as a precedent for further industrial growth in the area. This arguement was often supported by a statement that the units represent the first major application under the Utility Siting Act, and the eventual outcome will provide a "signal" to other coal conversion interests both in and out-of-state. Increased industrialization in the area was unanimously regarded by these persons as undesirable. It was expressed repeatedly that industrialization in the area would destroy a way of life regarded as having significant intrinsic value.

Those expressing approval of the proposal were almost all Colstrip construction workers. Many reasons were expressed, including employment opportunities, economic growth, increased tax revenues, a national energy shortage, and the opportunity to raise the local standard of living. It was also often expressed that construction of the units would constitute "progress," and that progress has served as a fundamental national value for many years.

MILES CITY, December 19, 1974, Custer County High School Auditorium.

The meeting in Miles City was attended by approximately 70 persons, of whom 31 made public comments. The majority of local residents who spoke opposed the project. The minority in favor of the units was generally composed of Colstrip construction workers.

Participants speaking against the proposal evidenced a considerable amount of concern about water quantity in the Yellowstone River. Many farmers of irrigated land stated that they feared a reduction in available water due to water use for Units 3 and 4. Some stated that even a relatively small reduction would hurt their operations during some years. Many also expressed a fear of the power plants serving as a precedent for further industrial water use along the Yellowstone, expressing their belief that several industrial firms have petitioned for water allocations of substantial size along the Yellowstone drainage.

BILLINGS, December 30, 1974, Lewis and Clark Jr. High School Auditorium.

The meeting in Billings was attended by approximately 650 persons, of whom 28 made public comments. The number of local residents who spoke was almost equally divided between those in favor of and those opposing the proposal.

Those speaking in favor of the proposal generally reflected commercial, industrial, and organized labor interests. In addition to employment, economic growth and increased tax revenues, speakers cited a national energy shortage, possible shortages of petroleum, and the opinion that coal represents the nation's most viable short-term solution to the energy shortage. Many expressed the opinion that current environmental standards are adequate and will be obeyed.

Those speaking against the proposal cited adverse environmental impacts, social disruption, population influx and adverse impacts to agriculture. Many questioned the public

need for the facility, and others advocated rail shipment of Montana coal. Impacts to the natural environment and agriculture were stressed, however.

POLSON, January 7, 1975, Polson High School Auditorium.

Approximately 80 persons attended the meeting in Polson, and 26 made public comments. Of the local residents who spoke, the majority opposed the project. In general, comments were equally divided between the power plant and transmission line portions of the proposal. Public need for the facility was questioned, and adverse impacts to the natural environment were cited. Transmission lines were criticized in aesthetic terms, as well as in terms of impacts on agriculture. Rail shipment of Montana coal was advocated, and a few persons advocated a moratorium on Units 3 and 4 until Units 1 and 2 have been operational for some time.

The minority that supported the proposal generally represented construction workers, electrical workers, and relatively large electricity users. The most prevalent reasons given for their support included need for additional energy and anticipated load growths.

ST. IGNATIUS, January 8, 1975, St. Ignatius Senior Citizens' Center.

The meeting in St. Ignatius was attended by approximately 60 persons, 43 of whom made public comments. The majority of the local residents who spoke were in opposition to the proposal. Public need for the porposed facility was severely questioned, and there was strong support for the idea of using conservation measures as a short-term solution to the national energy shortage, and concurrently developing alternative energy sources. Adverse impacts to the natural environment were cited, along with impacts to agriculture due to the transmission line construction and tower sites.

The small minority of local residents supporting the proposal cited employment generated by industries using electricity, as well as a national energy shortage.

MISSOULA, January 9, 1975, Hellgate High School Auditorium.

The meeting in Missoula was attended by approximately 1,000 persons, 38 of whom made public comments. A majority of local residents who spoke, mostly University of Montana students and faculty, environmental groups, and educators, opposed construction of Units 3 and 4. Public need for the facility was severely questioned, and many advocated electricity generation at the load center. Alternative energy sources were encouraged, and a few advocated a moratorium on a decision concerning Units 3 and 4 until Units 1 and 2 are operational. Adverse impacts to the natural environment were also stressed, along with fears of social disruption and a population influx due to increased industrialization of Montana.

The minority that supported the proposal generally reflected commercial and industrial interests. Reasons cited included economic growth, employment, tax revenue, anticipated shortages of petroleum and natural gas, and belief that current environmental standards are adequate. It was also pointed out that many jobs are dependent upon an adequate supply of electricity.

3. General Conslusions

Certain general patterns of opinion seemed to develop among categories of individuals who testified at the public meetings. Care should be taken, however, in any attempt to infer that these categories would be valid for the public at large. These categories simply represent the general orientations of individuals who spoke at public meetings. Whether these orientations are consistent with the opinions of the same categories within the public at large cannot be determined from the public meetings.

Of the total number of persons testifying at the meetings, the majority of those representing business, commercial, and industrial interests favored the proposal. Reasons given by the individuals for this orientation included economic growth, employment opportunity, increased tax revenues, need for adequate and reliable electricity resources, and the general feeling that coal-fired thermal generators provide a good immediate solution to the nation's energy shortages.

It should be noted that the above support was evidenced primarily in areas geographically removed from Colstrip. Business and commercial interests in Rosebud, Big Horn, Treasure and Custer Counties (the area immediately surrounding Colstrip) were generally not represented at the public meetings. Any conclusion regarding the opinions of business and commerical interests in that area would therefore be conjecture, with two exceptions. First, representatives of rural electric cooperatives who spoke at the meetings were uniformly in favor of the proposal. Some of these were located in the general Colstrip area. Second, construction contractors, as well as construction workers, generally supported the proposal, regardless of their location within the state.

In addition, representatives of organized labor for the most part supported the proposal. These individuals usually cited employment opportunities as the major reason for their support.

Residents of rural areas, ranchers and farmers, and other representatives of agricultural interests generally opposed the project. The majority of persons testifying at the meeting who were opposed to the proposal fall within this category. Among the many reasons given for this orientation was the opinion that the power plants would result in adverse impacts to the environment and agriculture. Public need for the proposed facility was severely questioned by this category of individuals. Generally, public need was interpreted to mean need for Montana only.

An overwhelming number of persons within this category expressed the opinion that projects such as Colstrip Units 3 and 4 would lead to increased industrialization of Montana. This anticipated industrialization was regarded as undesirable, and reasons cited for this opinion included fears of substantial population influx, social disruption, unfavorable impacts on available social services, and increased environmental pollution.

Generally, this fear of industrialization was expressed by a clear majority of all persons who spoke against the proposal. The Montana "way of life" or "lifestyle" was repeatedly referred to, and regarded as having an intrinsic

value that could not be measured in economic or financial terms. It was generally expressed that this valued "way of life" would eventually be destroyed if Montana were to become an industrial, rather than an agricultural, state.

C. COMMENT ANALYSIS

1. Individual Letters

a. General Discussion

A total of 596 letters regarding the Colstrip proposal were received by the Department from indivuduals. Generally speaking, letter writers, like the speakers at the public meetings, were predisposed toward discussing the advisability or inadvisability of the proposal, and called for either total approval or denial of certification. The following analysis of the public comment that was received through private letters is reported within that framwork. Similarly to the method used for public comment received at the public meetings, private letters containing specific technical points concerning the draft EIS were given to the Department's technical staff for consideration in developing the final EIS.

b. Analysis of Public Comment by Mail

Of the 596 letters received by EPD on the Colstrip proposal, a total of 443 expressed opposition to the proposal, and 154 letters expressed approval.

In an effort to more clearly define the nature of the public concerns involved, an analysis was conducted of the number of times specific reasons were given for each orientation. The following section gives the overall results of that analysis.

Because letter writers often cited several reasons for their opinions, the total number of reasons given will exceed the total number of letters. It should also be noted that interpretation of reasons given is somewhat subjective, and would vary slightly between individuals conducting the analysis.

LETTERS ADVOCATING CERTIFICATION

	TOTAL NUMBER
Letters from individuals and businesses	126
Letters from associations and citizen groups	20
Letters from government agencies	8

1. Broadwater County Commissioners
2. Choteau County Commissioners
3. Hill County Conservation District
4. Jefferson County Commissioners
5. Montana Bureau of Mines and Geology
6. Powell County Commissioners
7. Silver Bow County Commissioners
8. Sweet Grass County Commissioners

Reasons Given	Number of Times
Montana needs or will need electrical power	92
Environmental standards are adequate. Technological safeguards exist.	71
Employment would be created	53
Increased tax revenue and/or citizens' tax burden would be eased.	42
Economic growth for Montana would result.	41
The plants are needed to satisfy energy needs of Northwest and United States.	23

LETTERS OPPOSING CERTIFICATION

	TOTAL NUMBER
Letters from individuals and businesses	421
Letters from associations and citizen groups	19
Letters from government agencies	3

1. Buffalo Creek State Grazing District
2. Montana Public Service Commission
3. Wheatland County Commissioners

Reasons given	Number of Times
There is no public need for the proposed facilities in Montana.	109
Montana shouldn't pay environmental costs associated with the proposal.	101
Energy should be conserved.	61
Damage would be caused by power plant emissions (air pollution).	60
The Montana status quo should be preserved (usually referring to agriculture vs. heavy industry).	59
Water resources in the Yellowstone River might be decreased in quantity by withdrawal for the complex.	54
Alternative energy sources should be developed	43
The long-range implications of uncontrolled resource development are unattractive.	43

Reasons Given	Number of Times
The facility would cause social disruption.	40
The employment situation would not be improved in the long run.	22
The individual's tax burden would not be improved.	13
Rail shipment of Montana coal to load center is preferred	115
A moratorium on Units 3 and 4 until impacts of Units 1 and 2 can be observed in operation is preferred.	39
Other (miscellaneous)	66

LETTERS OPPOSED TO TRANSMISSION LINE PORTION OF PROPOSAL

	Total Number
Letters with specific statements opposing transmission lines.	52

Reasons Given	Number of Times
Aesthetics	25
Facility would take land out of production	7
Against applicants' preferred route	3
Other	18

2. Position Statements of Organized Groups

Various organizations and groups have submitted statements of position either for or against the Colstrip proposal.

a. Organized Groups Favoring Certification

Butte-Anaconda Traffic Club

Dillon Rotary Club

International Brotherhood of Electrical Workers(IBEW)

IBEW Local 32
IBEW Local 44
IBEW Local 185
IBEW Local 485
IBEW Local 532
IBEW Local 768

Lewistown Kiwanis Club

Missoula Automobile Dealers Association

Missoula Junior Chamber of Commerce

Missoula West Lions Club

Montana Building and Construction Trades Council, AFL-CIO

Montana Chamber of Commerce

Local Chambers of Commerce

Anaconda
Beaverhead
Billings
Butte

Local Chambers of Commerce (cont.)

- Great Falls area
- Helena
- Lewistown area
- Missoula area
- Superior

Montana Contractors Association, Inc.

Operating Engineers Local 400, Helena

Sheet Metal Workers International Association Local 169

South Central Montana Development Federation

Teamsters Local 45, Great Falls

b. Organized Groups Opposing Certification

American Association of University Women

Associated Students, Eastern Montana College

Associated Students, Flathead Valley Community College

Associated Students, University of Montana

Broadview Landowners Association

Environmental Information Center

Flathead Tomorrow

Flathead Wildlife, Inc.

b. <u>Organized Groups Opposing Certification (cont.)</u>

Friends of the Earth

Horseshoe Hills Association

International Brotherhood of Electrical Workers, Local 408

Lake and Missoula Counties Land Use Planning Committee of the Arlee Area Development Council

Meagher County Livestock Association

Montana Farmers Union

Montana Federation of Teachers

Montana League of Conservation Voters

Montana League of Women Voters

Local Leagues of Women Voters:

Bozeman
Missoula
Ravalli County

Montana New Socialist Party

Montana Sierra Club

Montana State Low Income Organization

Montana Wilderness Association

Montana Wildlife Federation, Dist. 1

b. <u>Organized Groups Opposing Certification (cont.)</u>

Northern Cheyenne Chapter, American Indian Movement

Northern Cheyenne Landowners Association

Northern Cheyenne Research Project

Northern Cheyenne Tribal Council

Northern Plains Resource Council

Northern Rockies Action Group

Ovando Advisory Planning Group

Rocky Mountaineers of Western Montana

Rosebud Protective Association

Skyline Sportsmans' Association

Tri-County Ranchers Association

United Transportation Union Local 978

University of Montana Student Action Center

University of Montana Student Environmental Research Center

Upper Missouri Group, Sierra Club

Yellowstone Basin Water Users' Association

Yellowstone Valley Audubon Society

c. Groups Specifically Opposed To Applicants' Preferred Transmission Line Corridor

Confederated Salish and Kootenai Tribes

Fish and Wildlife Service, U.S. Department of Interior

3. Comments Submitted By Telephone

These calls were received by the Citizens' Advocate office during the public comment period:

Number of calls supporting the proposal:	410
Number of calls opposing the proposal:	422

4. Comment Submitted by Petition

The following represents the total number of names on petitions submitted to the Department.

Petitions favoring certification:	1,123 names
Petitions opposing certification:	10,782 names

D. THE COMMENT

All written comments and petitions received by the Department have been filed with the Energy Planning Division. The public is welcome to inspect this material.

BIBLIOGRAPHY

Bradley, Richard C. The Costs of Urban Growth: Observations and Judgements. Colorado Springs: Pike's Peak Area Council of Government, 1974.

Briggs, G. A. Plume Rise. U.S. Atomic Energy Commission Office of Information Services, 1969.

Burchard, J. K. "The Significance of Particulate Emissions." Journal of the Air Pollution Control Association 24(1974): 1141-1142.

Cadle, R. D. "Formation and Chemical Reactions of Atmospheric Particles." In Aerosols and Atmospheric Chemistry, pp. 141-147. Edited by G. M. Hidy. New York: Academic Press, 1972.

City (Town) Clerk's Annual Financial Statement to State Examiner. Forsyth, Hardin, and Baker. Fiscal years 1970-71 to 1973-74.

Corn, M. "Urban Aerosols: Problems Associated with Evaluation of Inhalation Risk." In Assessments of Airborne Particles. Edited by T. T. Mercer, P. E. Norrow, and W. Stober. New York: Charles E. Thomas Pub., 1972.

County Clerk's Annual Report to State Examiner. Rosebud, Treasure, Big Horn, Powder River, Carter, Fallon, Custer, Prairie, and Wibaux Counties. Fiscal years 1963-64 to 1973-74.

County Clerk's Report to the State Board of Equalization. Rosebud and Powder River Counties. Fiscal Years 1965-66 to 1974-75.

Gregg, Don. Manager of Generation and Power Contracts, Montana Power Company. Personal Communication: January 1975.

Heimbach, J. A. and A. B. Super. "Air Pollution Potential Determination for Colstrip Montana. Final Report, Part II. Department of Earth Sciences, Montana State University. September 1973.

Heimbach, J. Memorandum to Carlton Grim. Montana State University. August 19, 1974.

Heimbach, J. Personal Communication. January 1975.

Heimbach, J. "Preliminary Results of Colstrip Ground-Based A_gI Plume Monitoring." Department of Earth Sciences, Montana State University, Bozeman. 12 November 1974.

Hidy, G.M.; Mueller, P.K.; Tokiwa, Yoshiro; Twiss, S. "Aerometric Factors Affecting the Evolution of the Pasedena Aerosol." In Aerosols and Atmospheric Chemistry, p. 219-236. Edited by G.M. Hidy. New York: Academic Press, 1972.

Hino, M. "Maximum Ground-Level Concentration and Sampling Time." Atmospheric Environment 2(1968): 149-165.

Hodder, Richard L. Sindelar, Brian W,; Buchholz; Ryerson,D.E. Coal Mine Land Reclamation Research Located at Western Energy Company, Colstrip, Montana. Research Report 20. Montana Agricultural Experiment Station, Montana State University: March 1972.

Long, L.W. "Analysis of Seismic Effects on Transmission Structures" IEEE Paper T 73 326-6. 1973.

Lucas, Therese C. The Direct Cost of Growth. Colorado Land Use Commission. Denver: 1974.

Montana Department of Health and Environmental Sciences. County Population Estimates. Unpublished. Helena, Montana: 1968.

Montana Department of Intergovernmental Relations, Old West Regional Commission. A Legal Study Relating to Coal Development -- Population Issues, vol. 1: Responding to Rapid Population Growth. 1974

Montana Department of Natural Resources. Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities. Helena, Montana: Energy Planning Division, 1974.

Montana Office of the State Examiner. Report of Examinations for High School and Elementary Districts #4, #12, #19 of Rosebud County, Montana. Fiscal 67-68 to 72-73. Helena.

Montana Office of the Superintendent of Public Instruction. Montana Education Directory. Helena, Montana: 1967 to 1974.

Montana Office of the Superintendent of Public Instruction. Summaries of Trustee Reports. Rosebud, Treasure, Big Horn, Powder River, Custer, Prairie, Wibaux, Carter and Fallon Counties. Unpublished fiscal year 69-69 to 73 to 74.

Montana Oil and Gas Conservation Divisions. Statement of Crude Oil Production and Valuation. Helena, Montana: 1967-1973

Montana Power Company. "Adjusted Firm Load Estimate." Unpublished: RCS 11/1/74a.

Montana Power Comapny. "Attachment 4 to Letter to DNR Dated August 27, 1974." Unpublished: 1974b.

Montana Power Comapny. "Attachment 5 to Letter to DNR Dated August 27, 1974." Unpublished: 1974c.

Montana Power Company. Letter to the Department of Natural Resources and Conservation dated November 19, 1974d.

Montana Power Company. The Montana Power Company's Long-Range Plan. Unpublished: April 1, 1974e.

Montana Taxpayers Association. Property Tax Mill Levies. Helena: 1963-64 to 1973-74.

Moses, H. and M.R. Kraimer, "Plume Rise Determination - A New Technique Without Equations." Journal of the Air Pollution Control Association 22 (1972): 621-630.

National Academy of Sciences. "The San Fernando Earthquake of Feburary 9, 1971: Lessons from a Moderate Earthquake on the Fringe of a Densely Populated Region." In Focus on Environmental Geology. Edited by R.W. Fank. Oxford University Press. 1973.

Nephew, E.A. Surface Mining and Land Reclamation in Germany. 1972.

Northern Great Plains Resources Program. "Workgroup D. Report: Atmospheric Aspects." Denver: June 1974.

Polk, B.V., and J.M. Hanson. "San Ferando Earthquake of Feburary 9, 1971: Effects on Power System Operation and Facilities." Unpublished Report of the Department of Water and Power of the City of Los Angeles: 1973

Roll, D.P. "A Review of the Health Effects of Sulfer Oxides." National Institute of Environmental Health Sciences. NIH Research Triangle Park, North Carolina: 1973.

Rosebud County. Budget and application for Mill Levies. Unpublished: Fiscal years 1973-74 and 74-75.

Rosebud County Planning Board. Written Communication to the Montana State Regional Coordinator. December 26, 1974.

Sandoval, F.M.; Bond, J.J.; Power, J.F.; Willis, W.O. "Lignite mine spoils in the Northern Great Plains - characteristics and potential for reclamation." In Some Environmental Aspects of Strip Mining in North Dakota: 1-24. Edited by Mohan K. Wali. North Dakota Geological Survey: 1973.

Sindelar, Brian W.; Atkinson, Richard; Majerris, Mark; Proctor, Ken. Surface Mined Land Reclamation Research at Colstrip, Montana. Research Report 69. Montana Agricultural Experiment Station, Montana State University: 1974.

Sindelar, Brian W; Hodder, Richard L.; Majerris, Mark. Surface Mined Land Reclamation Research in Montana. Research Report 40. Montana Agricultural Experiment Station, Montana State University: April 1973.

Slade, D.H., ed. Meteorology and Atomic Energy. U.S. Atomic Energy Commission Office of Information Services: July 1968.

Stern, A; Wohlers, H. Boubel, R.; Lowry, P. Fundamentals of Air Pollution. New York: Academic Press, 1973.

Super, A.B.; Heimbach, J.A.; McPartland, J.T. Air Pollution Determination for Colstrip, Montana. final Report, Part I. Department of Earth Sciences. Montana State University. April 1973.

"This is Meadowlark Farms." Reprinted fron Amax Journal. Undated.

Turner, D.B. "Workbook of Atmospheric Dispersion Estimates." Environmental Protection Agency, Office of Air Programs. Research Triangle Park, North Carolina: Revised, 1970.

U.S. Department of Commerce. Bureau of the Census. Numbers of Inhabitants-Montana Final Report PC (1) - A28. Population Estimates. Series P-26 No. 19 and No. 53. Washington, D.C.: Government Printing Office, 1970.

Westinghouse Environmental Systems. Colstrip Generation and Transmission Project, Applicants Environmental Analysis. 1973.

Williamson, S.J. Fundamentals of Air Pollution. Reading, Massachusetts: Addison-Wesley Pub. Co., 1973.